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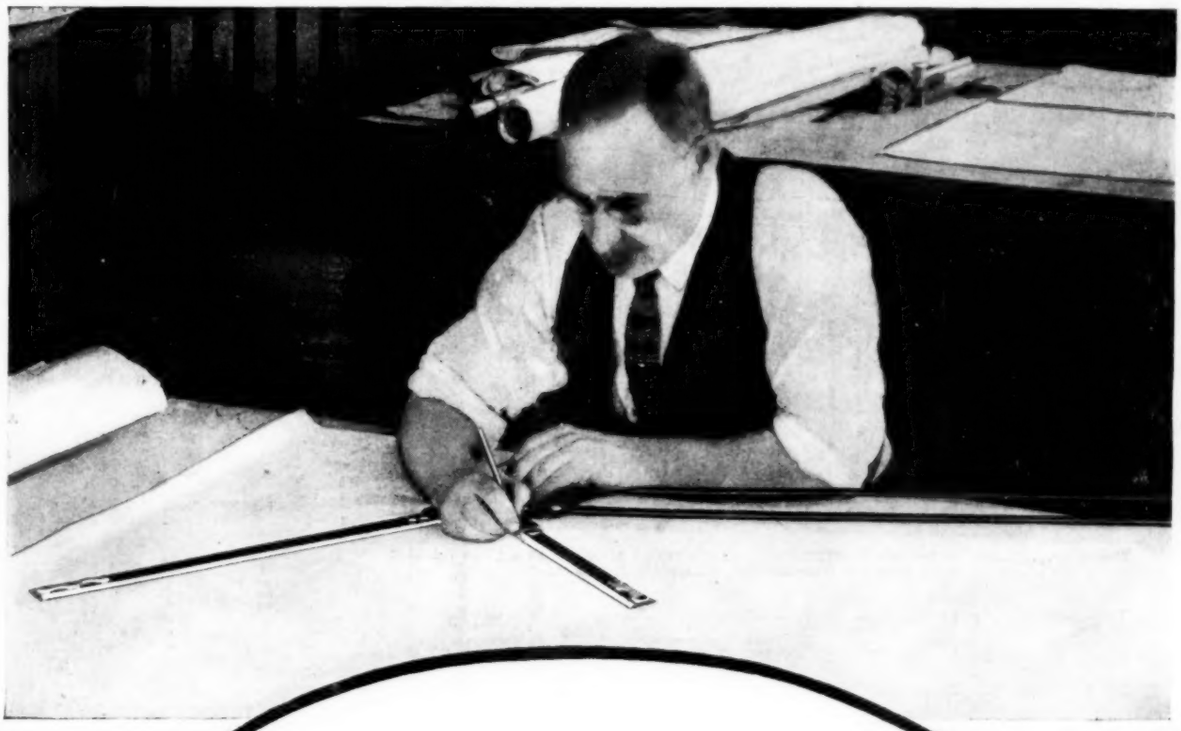

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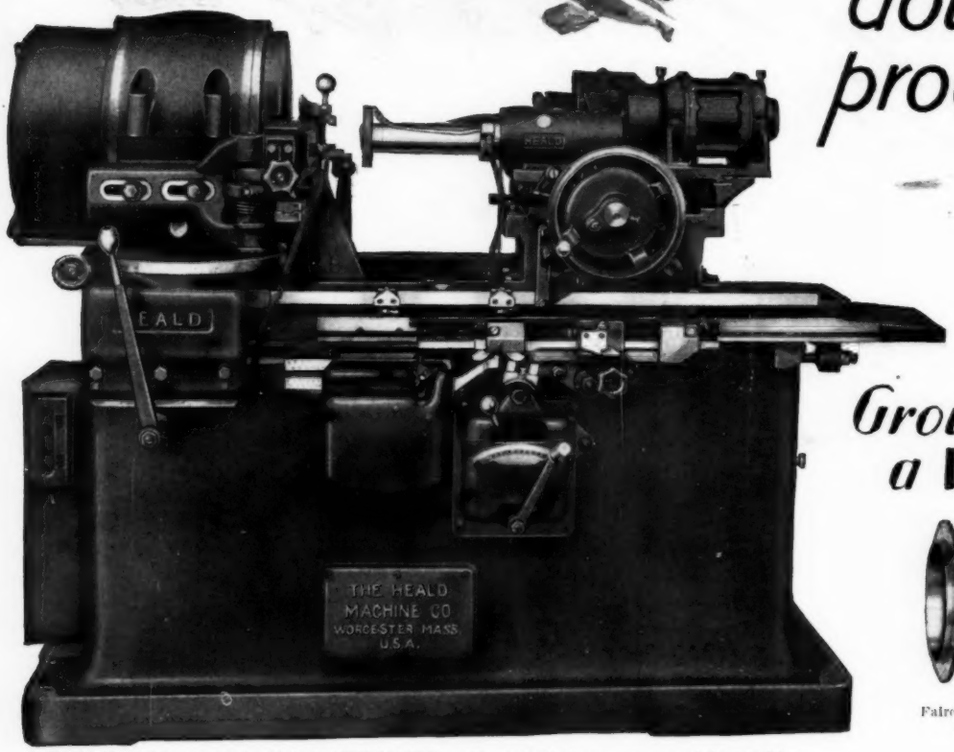

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JUDICIOUS INVESTMENT

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American Machinist

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Heat-Treating on Contract

By George S. Brady
Associate Editor, American Machinist

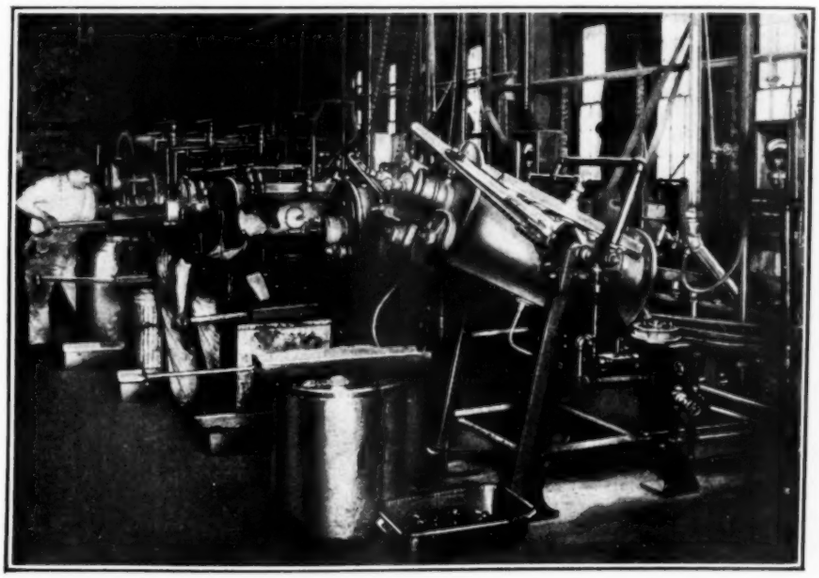
The heat-treating contract shop fills an important place, yet it apparently has a difficult road to follow—Some of the troubles analyzed

IN ANY analysis of the contract heat-treating shop situation, two contradictory factors are generally apparent, namely, the very important service that such shops are rendering to the mechanical industries, and also the high mortality among them. Heat-treating contract shops are usually small organizations, seldom exceeding fifteen furnaces and five or six men. But they have a wide range of work and an extremely rapid turnover of jobs, and generally serve a large number of manufacturing plants, often at very great distances. It is acknowledged that they take the difficult hardening work that the heat-treater in the production plant does not care to risk. But they also handle overflow work, rush jobs, and work of all kinds for shops that do not have sufficient heat-treating to warrant the hiring of a good heat-treater. But in spite of this, the number of contract heat-treating shops that go out of business every year is exceptionally high in proportion to the total in operation.

In one Eastern city, where the number of heat-treating shops averages four, the "mortality" of this class of shop since 1920 has been about 100 per cent every two and a half years. In other words, the average life of the heat-treating shop falls far short of a year's duration, especially when it is considered that some few have been in business for many years. Heat-treating has become a highly specialized art, and one that requires considerable experience and judgment on the part of the mechanic if the best mechanical results are to be obtained from the metal parts that are given the treatment. Heat-treating contract shops are acknowledged to be useful, and even vitally necessary in some centers. Yet it must be seen that something is wrong with an industry that has such a high percentage of failures.

It is the object of this article to describe the policies governing the contract heat-treating shops rather than the work which is being done by them. It is necessary, however, to have a clear understanding of the work that is being done by the successful contract heat-treating shops, as well as how they are conducting their business.

The men who start heat-treating shops are usually capable mechanics who have made good in practical heat-treating, or have been foremen in heat-treating depart-



A view of one side of one of the better equipped contract heat-treating shops. It shows a battery of rotary gas furnaces employed for carburizing, each furnace equipped with pyrometers. At the right is a row of small oven-type gas furnaces used for hardening tools and small pieces of work.

This shop is also equipped with several large oven furnaces and a gas-fired reciprocating-hearth heating machine. The latter machine is used for the rapid heat-treatment of small parts such as springs, ball races, machine needles, and office machine parts

ments. But in many cases they neglected to observe that the man who wrote the famous catch phrase about the better-built mouse trap died nearly fifty years ago, and knew nothing of modern, competitive, industrial conditions. Their failures have apparently been chiefly because of the neglect or improper handling of the executive end of the business, rather than because of the quality of the work.

Tool and die hardening constitutes an important item of the work handled by the contract heat-treating shops. Production plants that make their own tools frequently do not care to trust the toolmaker with the hardening of a costly tool that might easily warp or go out of shape in the heat-treating. The more intricate in shape, and consequently the more difficult to heat-treat successfully, the more apt is the maker to send it to the contract shop to harden. The next important source of regular work is the machinery builder who has cams, screws, gears, and other parts to be annealed or hardened regularly, but not in sufficient quantity to make it advisable to equip a modern heat-treating department and keep a capable heat-treater employed. Frequently, also, the large plants find jobs that are too large for their furnaces or heating pots, or are outside of the experience of their workmen, and they look to the contract shop to do this sort of work for them.

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YOUR ORDER No. 1928
OUR ORDER No. 24910
ORDER REC'D 7-30-28

DATE 8-2-28

CHECK 100		
CHECK 71		
CHECK 22		
CHECK		
FURN. GAS		
CARB. GAS		
COMP. LB.		
BONE LB.		
CYANIDE		
CARBONIA		
HD. OIL		
PACKING		
FGT. EX P. P.		
WORK REC.	7-31-28	
COMPLETE	8-1-28	
TOTAL COST		

Cased in 2 charges in #2-B Carbonizing Machine added 2½ lbs. raw bone for every 100 lbs. rollers, made test in 2½ hours, made another test in 4½ hours - O.K. Quenched in oil.

1 charge of small rollers were cased in #1 Carbonizing Machine for 4½ hours, then quenched in oil.

Shop order form used at the American Metal Treatment Company. The form is made out in quadruplicate with the data entered at the top. The first copy is the invoice, the information in the body of the form being filled in after the work has been completed. The second copy constitutes the office record, the third copy the shop record, and the last copy goes to the bookkeeper. All contract systems are essentially the same

There seems to be no standard in the various contract shops for quoting prices on the hardening of tools, nor any relation between the cost of the tool and the price obtained for hardening it. Much seems to depend on the amount of work of the same class going through the contract shop at the time. As an example, a shop quotes the price of 50 cents each for hardening four small hobbing dies worth $100 apiece, puts them together in a furnace with six other jobs, and actually realizes a profit on the $2 received for the work. But some time later another lot of four comes in for hardening when there is no similar die work at hand. The furnace has to be started and the oil bath heated, so that the contract shop cannot bill the same price and realize a profit.

But the purchasing agent of the production plant expects the same price which he had before. This constitutes the first weak link in the system. The purchasing agent gets quotations all around until he places a job at the lowest possible price from the shop lucky enough to have similar work at the time. But this shop is not the one that will have the lucky run next time, and if it wants to hold the business it must take it at a loss when it comes in again. As a consequence, the average heat-treating shop is losing money as often as it is making it, and the shops very generally agree that they are "cutting each other's throats" by making their bids fit the jobs at hand, rather than the worth of the job itself.

This naturally brings up the question of responsibility for the spoilage of work done by the heat-treater. An intricate die will warp easily with improper handling, and so throw holes or surfaces out of line so that the dies will not cut accurately. If the steel was not chosen properly in the first place, the die may also be damaged in the hardening. The heat-treating contractor naturally resents taking the responsibility for close work, if he is to be paid as low as $5 for hardening a die valued at $300. Taken on a time basis, such a job may be considered to yield a profit because it has taken a workman less than an hour to do the job. But nothing has been paid by the owner for the skill required, nor the risk involved. Nor is there any "premium" included for the risk taken by the heat-treater in handling materials selected by someone out of his control.

One very successful heat-treating shop will guarantee die work and will pay for any cracked or distorted work. But it charges in such cases 10 per cent of the value of the tool. This price has been found to give sufficient leeway so that haste is avoided and proper attention is given to the details of the whole process, still permitting a decent profit on the job. This added attention in itself results in better work, and on one class of extremely accurate die work, this shop reported no spoilages in nine years under the system. The payment of the additional amount required by the guarantee may be considered by the owner of the tool as an insurance premium. He gets his return in elimination of the monetary loss in case of accident and by avoiding costly delays due to spoiled dies that might have to be made over.

Heat-treating of quantity parts does not ordinarily offer any difficulties to the contract shop. When the first order is placed, it is usually with the statement that a given quantity will be sent for treatment each month, and the price is set accordingly. This work includes the hardening of springs, casehardening of bolts, screws and washers, or the annealing of drawn articles. Quotations are generally made on a pound basis, or by the hundred, and the time factor is such that no special furnace arrangement need be made. This class of work may be

obtained from a considerable distance, whereas tool and die work is usually obtained within a general radius of 50 to 100 miles from the heat-treating shop. Production work is not affected as easily by local business conditions as straight tool work, and moreover forms a stabilizer for the contract shop in still another way by serving to keep the workmen busy and the furnaces in operation, and straighten out the irregularities of tool jobs. No contract heat-treating shop, therefore, can consider itself on a secure foundation until it has obtained some regular production jobs.

The equipment of the average successful heat-treating shop usually consists of an assortment of furnaces picked to give a range of sizes to suit the work obtained in the locality. Practically all of them are equipped with simple installations of pyrometers, but in general there is not the tendency to keep up with the most modern equipment that is apparent in the small manufacturing plant in general. This is claimed to be due to the fact that the intense competitive "bidding down" does not leave enough margin for the purchase of new equipment as long as the old equipment will produce. Naturally this compels the shop to employ greater labor skill in doing the work, and with the consequent endless cycle always away from progress, making the second important reason why so many of these shops are forced out of business.

Materials an Intangible Factor

Materials constitute an almost intangible factor for the average contract heat-treater. He buys gas, oil, compounds, cyanide and other materials, yet they seldom enter his cost calculations. In reality they are usually too small to figure against any single tool job, but it leaves him in the position of having just one more item of expense that is left "up in the air." From beginning to end, therefore, guess work and so-called "judgment" are the bases for most of the quotations made by the heat-treating contract shop. So large a proportion of these "judgments" have been wrong in the past that the average shop has passed out of existence in a short time, and the majority of those that have carried on never reach the point where they can keep up to the times on equipment, materials cost, or proper distribution of overhead.

The heat-treating shops that are successful have comparatively simple systems. When a job comes in the parts are looked over by the heat-treater in charge, and an order is written out. This order contains the heat-treating instructions, and remarks concerning the particular points to be watched to avoid trouble. It also designates the furnace for the work. After the work is passed through the shop this order is filed by its number as a permanent record of the treatment given the piece. If the same job is repeated at a later date the receiving clerk writes out the new order by copying the instructions on the first one together with any added comments noted by the man who did the work. A ledger account is kept of all work done for customers, so that the order is easily traced at any time. The shop that considers itself too small to keep these simple records not only is working on dangerous ground, but it cannot hope to convince its clients that its work is of sufficient worth to warrant high rates.

The successful heat-treating shop also does real sales and advertising work. It is not enough to "do a good job" of hardening and simply return it. Heat-treating does not speak for itself. Only the jobs poorly done are the ones that speak. The client does not always appreciate that the reason why he got exceptional service out of a set of dies was because the heat-treater did particularly fine work in hardening. It is not at all unlikely that the manufacturer will accept a lower bid next time to save a few dollars in the hardening of a tool and unwittingly lose many thousands of dollars in reduced production. It is necessary to educate the manufacturer on the service performed by proper heat-treatment.

In view of the present general knowledge among engineers and manufacturers in regard to the importance of proper heat-treatment, it is preposterous that the hardening of costly tools and parts should be done on a purely price basis as if the operation consisted merely in heating and dipping in water. Yet, this is what is now fairly general practice in dealing with contract shops. Such a condition is hardly the fault of the manufacturer. It goes without argument that almost any production shop will gladly pay more for work or equipment that is positive and will produce maximum output. No shop that makes a die or tool wants the delay arising from spoiled work, even though it is paid for. The present attitude of the purchasing agent who shops around for prices may be that one contractor is as bad as the other, but apparently little effort has been made except by a few progressive contract shops to dissuade him of this theory.

Procurement of Orders

In regard to the actual procurement of orders, the heat-treating plant seems to be little different from other kinds of contract shops. It is largely a matter of being known in the trade and locality, and once the company builds up a reputation a certain amount of work naturally comes in regularly. The advertising that is done is of general nature, and follows the lines of reputation building. But the personal contacts are generally persistent, and usually one of the proprietors, or the manager, is "scouting" for the right kind of work at all times in order to have enough jobs on hand to keep the equipment and the employees busy. The variety of parts and tools handled for heat-treatment is generally very wide, but the treatment given them can usually be classified so that the shop can be put on a fairly regular production basis.

Editorial Service from Abroad

Next week there will appear the fifth European observation article, based on a rapid survey of conditions in representative Czechslovakian machinery plants. These articles are in line with the policy of the *American Machinist* to give to the executive, who has little time for reading, the broadest possible viewpoint on the industry by furnishing concise information on progress in other countries as well as at home. The industrial news letters published monthly from regular correspondents in London, Paris, Berlin and Canada are part of this service, as well as occasional articles on the best practices in leading foreign plants.

Profits for Builder and User

THE executive committee of the Manufacturers' Association was in session over the question of prices. Not a price fixing to boost the list prices, but to determine on a fair margin of profit for builders of machines. A large user and his P.A. and Bill Holland had been invited to sit in. Mr. Jackson, the manufacturer, started the discussion.

"We don't want anyone to work for nothing. We want a fair profit ourselves. But when Armstrong here tries to make me pay three thousand dollars for a machine that can't cost over five hundred to build, I balk. I'll do without it. I won't encourage profiteering."

"Just what is your idea of a fair profit?" said Brownell, the president.

"It's, er—hard to name an exact figure," hesitated Jackson. "But twenty-five to thirty per cent ought to satisfy anyone, it seems to me. We seldom net as much as that."

"How about it, Mr. Holland?" asked Brownell.

"It's a delicate subject, boys," replied Bill. "And there are several ways of looking at it. It's hardly fair to reckon profits from a single machine. Jackson has lean years and good years. Once in awhile he cuts a melon that stretches his thirty per cent quite a bit. If he is like many others he has some items on which he makes fifty per cent and others on which he's glad to keep out of the red. Perhaps it's the same way with Armstrong. This may be one item on which he feels justified in making up for machines that are not profitable, but seem necessary."

"Poor business, Holland. We don't relish paying a big price because Armstrong sells other machines too cheap," said Wilton, the P.A.

"Perhaps there's another way of looking at this," replied Holland. "Suppose Armstrong told you the machine wasn't for sale but that you could use it for half your present cost of doing its work."

"I'd be mighty glad to do that, Mr. Holland," spoke up Armstrong. "I'd make a lot more money than I will at three thousand dollars. I'd make that much a year, just as Jackson will if he buys it, even at my price."

"I don't see just what that has to do with the price question, Mr. Holland," said the P.A.

"It's an open question, Wilton, just how much Armstrong's profit concerns you in any way. There is no compulsion about buying his machine at any price. As one of my friends puts it—'it's my profit that concerns me and not the other fellows.' In other words, your problem is to decide whether the machine is a good investment at Armstrong's price. If it is, you're losing money if you don't buy it."

"It will pay for itself in a year, Mr. Holland, probably less. It took years of experience to design that machine. I'm cashing in on the experience gained when I was making a bare living," said Armstrong.

"Wilton says it's poor business for me to make a low profit on some things and charge him a big price for this. Jackson says they rarely make thirty per cent on their product. If that's true his business methods are as bad as mine. He'll make a hundred per cent profit on my machine and then he gives it to his customers at my expense. I'd be mighty glad to be insured twenty-five per cent profit on my whole business, year after year. But as long as I can't get that, it's up to me to get a fat price when I know my machine will pay the buyer a bigger return than he can get in any other way."

"There are those," said Holland, "who advocate the lease system for high-production machines. It's a sort of piece work plan for the builder of the machine. He gets a percentage of the savings as long as the machine saves money for the user. Some contend that this is the only way in which the designer and builder of special, high production machinery can be adequately paid.

"George Corliss asked so much for his steam engines that buyers balked at the price, like Wilton here. He installed them without cost on a contract to receive half the coal saved over a certain period. He earned so much money that in many cases the user paid a premium to be allowed to buy his contract. Perhaps Armstrong

would like to play the same game. But the question remains—is it any of the buyer's business what the maker's profit is—or should he be concerned only with what the machine is worth to him?"

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Asking Quicker Deliveries Than Are Needed

Many buyers insist that machines be delivered earlier than needed simply because experience has taught them that promises made by salesmen are not always fulfilled by their employers. To cite an example, we received last week from a large grinder concern a tool which its sales manager promised a month ago. Even in order to get this unsatisfactory shipment, it was necessary to send a veritable barrage of telegrams, letters, and phone calls, all of which added unnecessarily to the overhead of both companies.

The habit of discounting deliveries is admittedly expensive and annoying to the conscientious manufacturer who works day and night to meet the date specified and then finds that shipment could have been made two or three weeks later without harm. But from the buyers' viewpoint, there are few things more exasperating than holding up operations for an overdue machine, when everything else necessary to the production program is ready.

One solution to this problem is to place the order with a concern which has a past reputation for prompt delivery, and to plan schedules accordingly. Another solution is to exact a penalty from the vendor who fails to meet his promise, or a bonus from the purchaser who demands extraordinary speed. In the long run, it is certainly much better to sell the buyer on the idea of an extra charge for extra service than to accept an impossible delivery, with its consequent loss of good will. —H. KLING.

Too Much Inspection

An inefficient inspection department is bound to place defective articles in the hands of customers and thus cause a loss in sales. A certain industry, one of the largest producers in its field, suddenly experienced a decrease in sales. After spending considerable time in locating the cause, it was found that a large number of defective articles were reaching the consumer.

An inspection superintendent, who had made an enviable reputation elsewhere, was employed to set up a new organization. He made a record of every inspector under his jurisdiction covering the work they were performing, and their general education. He then proceeded to make a study of each part being manufactured, the operations required and the amount of inspection required on each operation. From this information, he set up a system of inspection sheets, similar to operation sheets.

While this work was being completed, a record was made of the amount of work that each inspector was capable of performing efficiently. With the completion of the above studies, a reorganization of the department was put into effect and a bonus system applied on the amount of work covered in a day. In the case of floor inspection, the inspectors were given so many machines to cover in a day, together with the proper inspection sheets required on the job. The bench inspectors were taken care of in a similar way, each one being given charge of the necessary gages and inspection sheets to go with the job. If a question arose, the inspection sheets were referred to for the desired information, or the inspection chief was consulted.

This system, although simple in character, resulted in a reduction in the inspection force after it had been in effect for a period of three months. When the following year's sales were tabulated it was found that a new record had been established. —FRED A. SCHMIDT.

Selecting Shop Executives

Possibly psychoanalysis can determine whether or not a man has the makings of a good executive, but this scientific aid to hiring has not been developed to the point where its findings can be accepted as infallible. Experience, health, training and past performance are much better criterions by which to judge an applicant's fitness. Because it has positive data on all these, the company which promotes men from its ranks has an advantage over the firm which goes outside for its executives.

On the other hand, it is true that outsiders are usually able to view problems from new angles because their minds are not influenced by tradition or by methods that have been used in the past. If it is felt necessary to bring in an executive, preference should certainly be given the man who has had practical experience in the mechanical field over the one who has made his mark in some other line. The latter may be successful in the end, but much time will be lost while he is familiarizing himself with the general principles of shop practice. This time can be saved by selecting a man who has a working knowledge of the shop and a fresh perspective. —H. C. KLINE.

Fig. 1 — Crankshaft forgings to be heat-treated are brought by truck to an operator who centers both ends, after checking the general alignment. Then the shafts are placed in a charging device from where the automatic operation begins, including passing through two rotary-hearth electric furnaces. Crankshafts up to 4 ft. in length can be accommodated

Crankshafts Heat-Treated Automatically

Photographs by courtesy of the Ingalls-Shepard Division of the Wyman-Gordon Company

Fig. 2—At the right is the charging trough of the hardening furnace, while towards the center is the discharging mechanism. As each crankshaft is forced out on the last 2 in. of the discharge stroke, a pusher head trips mechanism which allows the forging to fall into the quenching bath. A conveyor reaching to the bottom of the quenching tank then carries the work to the next furnace

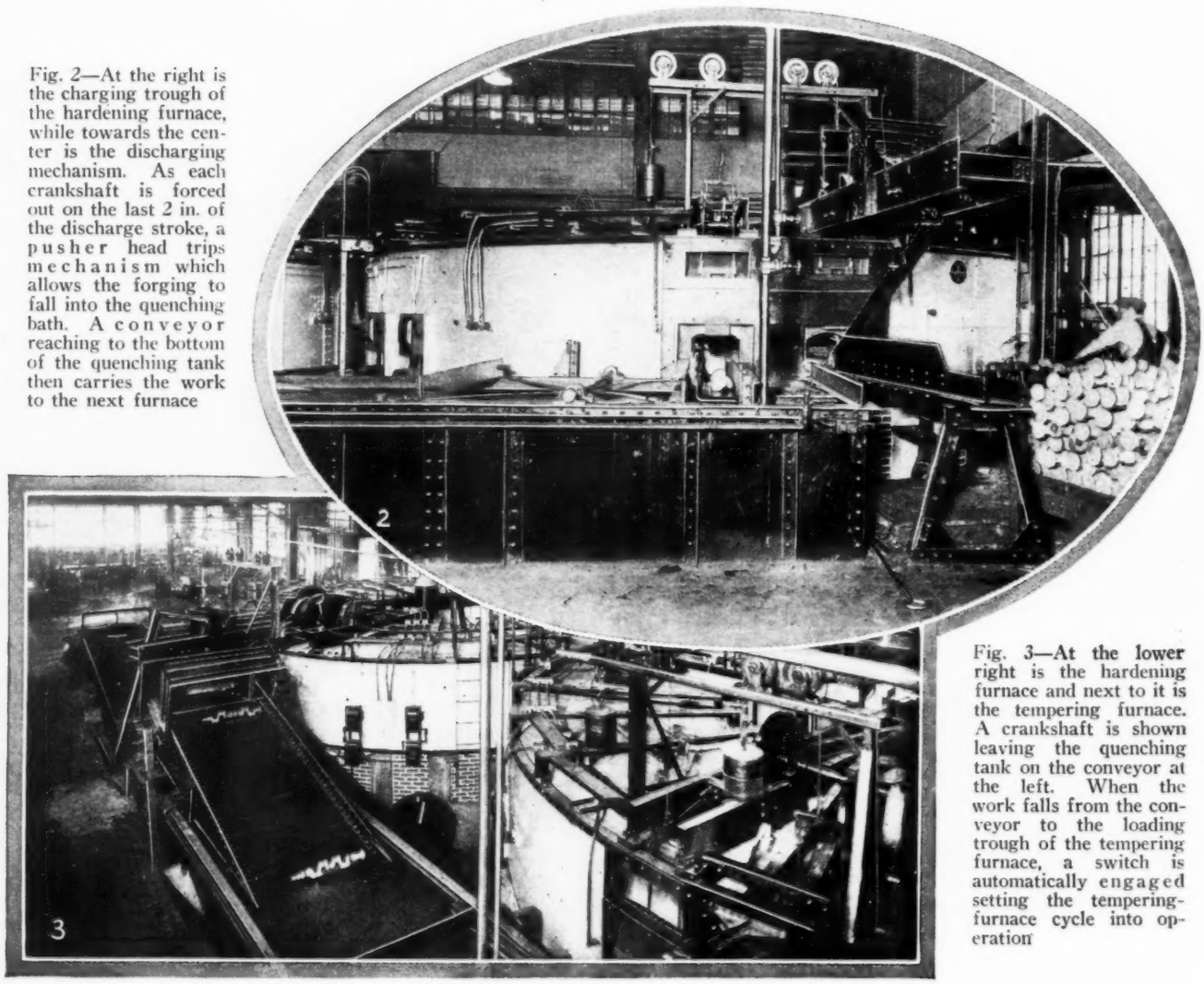


Fig. 3—At the lower right is the hardening furnace and next to it is the tempering furnace. A crankshaft is shown leaving the quenching tank on the conveyor at the left. When the work falls from the conveyor to the loading trough of the tempering furnace, a switch is automatically engaged setting the tempering-furnace cycle into operation

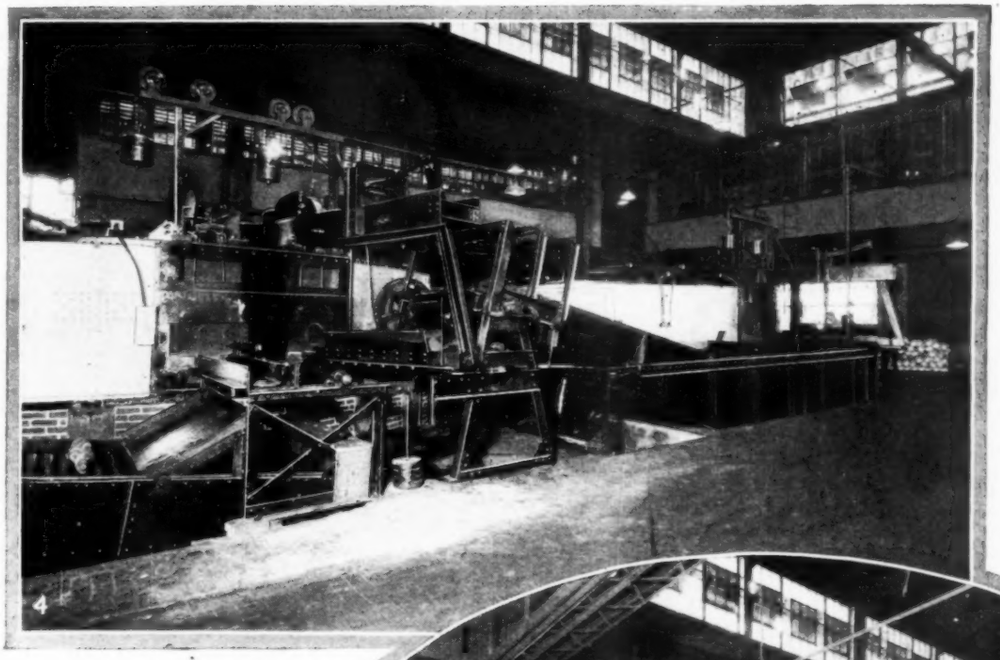


Fig. 4—This view shows the charging and discharging sections of the tempering furnace. Through speed-reducing gearing, a 3-hp. motor, located on the top of the furnace, drives the charging mechanisms. The same motor operates the mechanism for opening and closing the furnace doors

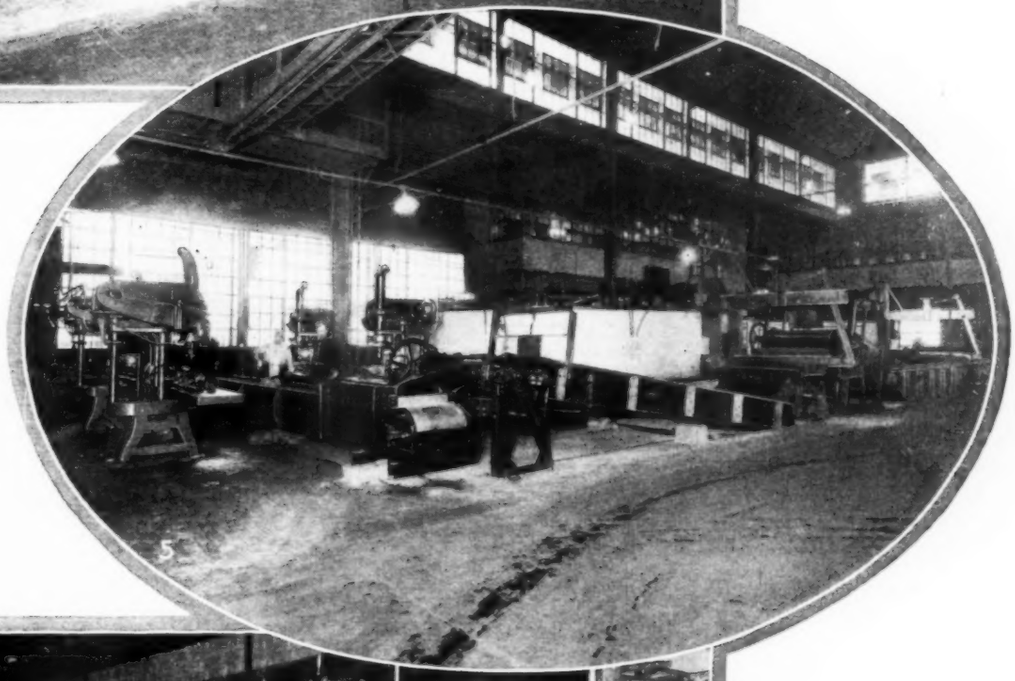


Fig. 5—General view of the furnaces, showing how the work is transferred from the conveyor leaving the tempering furnace to the flat-belt conveyor operating at right angles to it. Each furnace is 32 ft. in diameter, the size of the hearth being 23½ ft. in diameter. A 3-hp. motor is used to drive the hearth. The furnaces are located in the line of regular shop operation

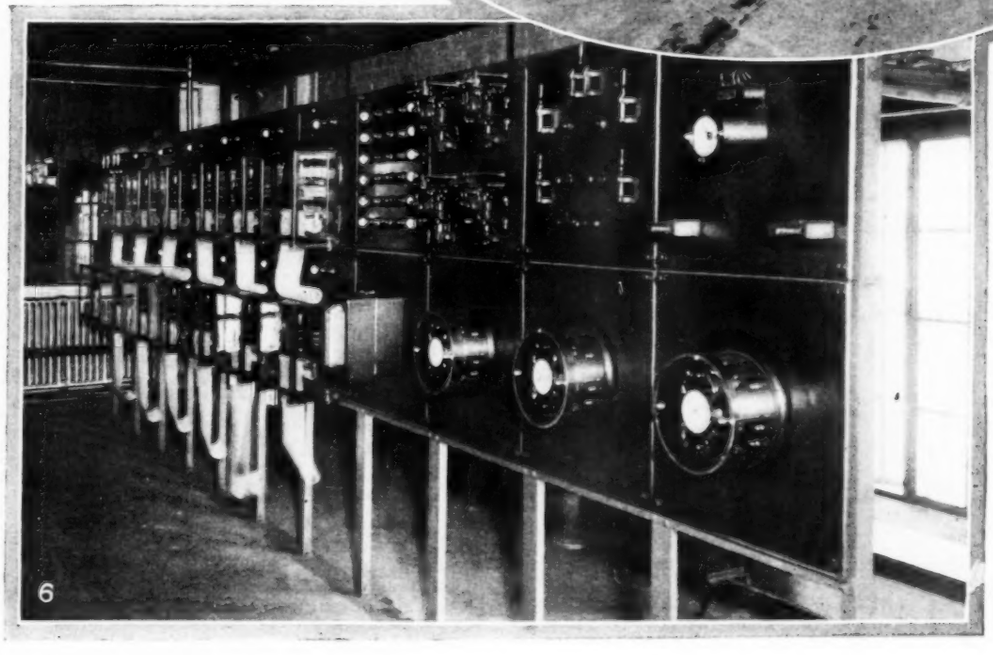


Fig. 6—Each furnace is divided into six electrical zones. The instruments in the control room permit checking the operating efficiency of the furnaces. These instruments record the power consumption on the primary and secondary sides of the transformers. In connection with the charging mechanism two magnetic counters are used to record the production

THE · FOREMAN'S · ROUND · TABLE

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Letting Good Men Get Away

"I SEE you've lost young Jimmie Morris, Ed. I thought you said he was a 'comer' and that you wanted him for an understudy after Tom Bristol goes to the erecting gang."

"I did want him, Al. And I'm darned sorry he's gone."

"How come he got away from you? Did he know you had him lined up for advancement? Did he know that you thought he was doing a good job?"

"No, I can't say as he did. I couldn't promise him anything, and I wanted to surprise him a bit."

"And you let him surprise you by quitting. Can't blame him much if he had a good offer and you hadn't said a word to him as to possibilities ahead. Hadn't you ever told him he was good and ought to be in line for promotion?"

"I don't believe in handing out soft soap, Al. I expect every man to do a good job without any special praise. If he makes good I advance him when I get a chance. And Jimmie ought to have known he'd get his if he stuck.

"Seems to me he went off half-cocked. I always found it paid to stick around and wait for an opening. And you never jumped all over the country chasing from one job to another."

"No, Ed. But I've usually worked under a boss who didn't try any of this mystery stuff, but told me when I did a good job, and what the chances were for advancement. I did work for one man who never said a word when you did a real job, but who cussed you out when anything slipped. He lost good men right along and always had a line of bull about the great mistakes they made by leaving just as he was going to do something for them."

"But you can't be promising better jobs to everyone, Al."

"Of course not. But if I had a man who looked good enough to me to step into a better job in the near future, I'd find some way of slipping him the glad tidings so he wouldn't jump out from under my nose just when I needed him. I'm betting that if Jimmie had known what you had in mind, he'd be here now."

Is Al right in feeling that men should be told of possibilities ahead? Or is it best to follow Ed's plan and not commit yourself at all until the time comes? How can you let a man know that you hope to advance him without a definite promise?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Equipment and the Foreman's Reputation

WHEN the tables and bed plates, especially on drill presses, lathes, and milling machines, are out of true, it is impossible to make either parallel or right angle cuts with any degree of accuracy. When this state of affairs exists in a shop, it is certain to retard production.

Many a good mechanic has been held responsible for running the cost of a job beyond the estimated cost because the foreman did not realize the extra work required in setting up a job on inadequate machines. A foreman should know his men and the condition of his equipment. Upon this knowledge rests his reputation and his success as a foreman. —E. L. FAIRALL.

•

ALL IS wrong in thinking that a foreman may be held responsible for a poor showing when the fault is poor machinery. The foreman is there to manage and direct, keep the machinery in proper order, and discipline, direct, and control the men under him. The shop manager should be keen to remove from the foreman such tasks as do not bear directly upon production. It is the foreman's duty to turn out the maximum of good products. To do this he must have good machinery supplied to him without effort on his part.

If Bill Jenks has complained to the shop manager about the poor machinery without result, all the worse for the manager who is the loser, and there is no reason for Bill quitting. Bill was hired to work with the equipment that was there. If it was poor, he should have done the best he could with it. I certainly agree with Ed that Bill did wrong to quit. —EDWARD PIRANIAN.

Hiring in the Open

IT IS granted that when an employer goes for help, the floaters have to be picked over. However, there are many valuable and efficient men and women in the floating throng. It is, or should be, part of the duties of executives and foremen to pick them and solve their complex, in lieu of dismissals and indifference which force them lower down the grade toward useless lives.

Any foreman, who is performing properly his duties, and has the proper support of his superiors, should be presentable at all times and cheerful. He should greet and talk with all prospective subordinates, in order to judge their general characteristics.

On reporting for duty, new help should be introduced to those in their immediate surroundings and to those with whom they will come in contact in the performance of their duties. With the introduction, a brief outline of the duties to be performed should be given, in order that the new worker may know what relation to the scheme of things around him these fellow beings hold. —H. G. DOWNS.

THE · NEXT · TOPIC

Making Foremen—or Importing Them

ADVANCE QUESTION

Williams is nursing along a toolmaker to be foreman so as to avoid hiring one from the outside. Ed thinks he's foolish. Al thinks he's right. What is the answer?

Wear Goggles or Quit

ENFORCING any rule is a matter of supervision by the foreman. An employee who breaks a rule for the first time does not always do so deliberately, and the foreman should draw his attention to the infraction, at the same time impressing upon him that the next infraction will lead to a lay-off or discharge. The foreman or safety supervisor should at this time impress the employee with the importance of using safety devices, protective appliances, etc., provided by his employer, not simply to conform to the rules and regulations, but for his own protection.

Hanging a pair of goggles at a grinder and posting a notice that goggles must be worn when grinding has its drawback, as no one wants to use goggles that have been worn by a fellow employee who has sore or inflamed eyes. In several instances this practice has led to an epidemic of a series eye infection.

Equip the grinders with eye shields, assign some one to keep them clean, and keep wheel guard and shield in position. This will reduce to a minimum eye injuries which are sustained when using a tool grinder.

—WALTER CHARLES, *Safety Engineer.*

Keeping a Machine Busy

WHERE a machine is in constant use the new machine requires serious study. The annual saving should be calculated and compared with initial cost. Such factors as possible price for the old machine, depreciation and estimated sale value of the new machine at the end of its life should be considered. The new machine should show marked improvement over the old if the replacement is to be authorized. In making this study it may be necessary to estimate an average volume of work over a considerable period. —W. R. NEEDHAM, *England.*

Specification and Procurement *of Manufacturing Materials*

Methods Employed at the Wright Plant

By E. T. Jones
Chief Engineer, Wright Aeronautical Corporation

ENGINEERING materials and production materials are treated separately at the plant of the Wright Aeronautical Corporation. Engineering materials are all those that go directly into the product of the plant, while production materials include the lubricating oils, cutting compounds, tool steels, and other materials employed by the factory in manufacturing the product. The organization of the plant is divided on a similar basis into engineering and production departments, the first in charge of a chief engineer and the latter under a factory manager. Due to the nature of the product manufactured, which is airplane engines, engineering is considered all important. While the ordinary machine can tolerate occasional failures in service, it is highly important that every material entering into the construction of an airplane engine must be of proven capacity so that the possibility of a failure in flying is reduced to the absolute minimum. All questions of saving time or money in production, therefore, are subservient to quality and correct treatment in the materials entering the construction of the engine.

In this third article on the procurement of materials it is shown how the rigid requirements of specifications and inspection of materials in the building of airplane engines makes it necessary that the technical experts be given the major responsibility for procuring the best material

The engineering department specifies all engineering materials, and is directly responsible for all failures. The chief engineer is the "last word" on design and engineering materials, but all technical questions pass through the hands of the metallurgist, who constitutes the plant authority on the physical properties of materials. The laboratory writes all specifications for purchase and inspection, and for the heat-treatment of the material in process. The metallurgist is not responsible for general design, but is expected to look after all points of design that affect the material, such as having corners rounded and thin sections avoided that would make heat-treatment difficult. He signs all design drawings before they are sent to the shop.

In the design of a new engine the designers naturally have the background of previous experience, complaints of weaknesses, information on what other companies are using, and knowledge of what the chief engineer is trying to accomplish. With these they can proceed on the design. Materials problems are always in the foreground, since it is never assumed that the ultimate in correct materials has been reached. When a material has been adopted after test, it is considered as a standard and exact specifications are prepared, and it is not replaced by another new material until the latter has been found to be superior by actual tests. An example is the selection of the aluminum alloy for the piston. Light weight was of great importance, but strength and heat-resistance were also vital factors, and it was also important to obtain a commercial alloy. It was therefore put up to the laboratory to find a material that would give the best results on all factors. It has been found most desirable to stick as closely as possible to commercial materials that can be obtained in quantity on the open market. The standard S.A.E. steels are employed, although it is necessary in some cases to specify to the mills closer limits of carbon and other content than is called for in the regular S.A.E. specifications. In like manner bearing bronzes, heat-resistant alloys, and light alloys for castings are generally commercial materials. Small parts that are highly specialized in themselves, such as springs, valves, and spark plugs are bought from manufacturers who specialize in them, but they are all subjected to rigorous tests before adoption.

In general, the total number of different engineering materials used in airplane engine construction is lower than for many other machines. This is probably due chiefly to the fact that because the highest grade of material possible for a given condition is sought, with cost as a lesser factor, the same high-grade material is also used for the minor requirements. Only 28 different steels and 18 different non-ferrous metals are employed regularly in the construction of the product, and the engineering department aims to keep this figure down as much as possible.

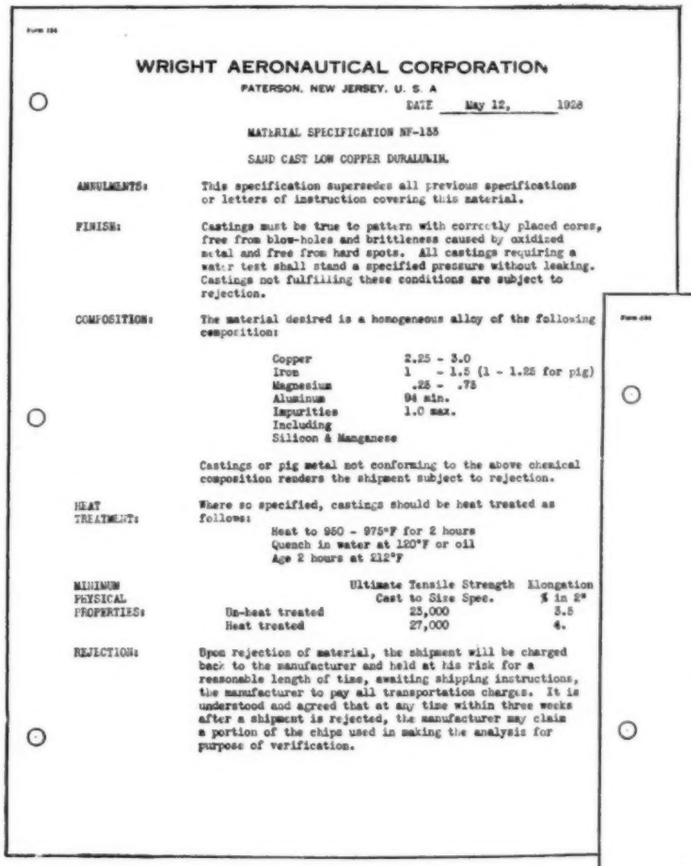
The testing of materials is under control of the metallurgist, and a fully equipped laboratory is provided for this purpose. He is expected to keep in touch with new materials being placed on the market, and in addition he may receive suggestions from the designers or from other sources. If a materials salesman presents himself to the purchasing agent with a new material, he is sent to

the metallurgist, and if his claims sound reasonable samples are requested and tested in the laboratory. New materials that have met the laboratory tests are incorporated into test engines and run on test stands under severe operating conditions. They are required to meet all stand tests before going into production. If complaints or suggestions come from the field they are likewise referred to the engineering department. Usually the question of design enters as well as that of the proper material, and only those matters having to do with the physical characteristics of the materials are referred over to the laboratory.

In the procurement and handling of engineering materials through the plant the inspection department plays an important rôle. The chief inspector is independent of both the engineering and the production departments, and for final decisions reports directly to the general manager. He is given "inspection specifications" by the metallurgist for all engineering materials entering the plant, and for parts manufactured in the shops he is provided with part drawings on which the engineering department has specified the material and the heat-treatment. Neither the production department nor the purchasing agent can change the requirements of these specifications and drawings without proper procedure of the metallurgist and chief engineer. The inspection department gives the material the ordinary visual and hardness tests when it is received from the vendor. Where tensile or chemical tests are necessary the inspector takes off test specimens and sends them to the laboratory. After the laboratory reports the results to him, he is then able to pass or reject the lot of material.

The general policy of 100 per cent shop inspection is followed in regard to materials in process. This is found to be necessary due to the varying physical characteristics that can be developed by different heat-treatments. The process inspections for hardness, impact, and other characteristics are carried out by the inspectors under the specifications prepared by the laboratory.

Another feature of the procurement of materials for airplane engine building that does not ordinarily concern the average machine builder is the inspection of basic materials at their sources. This was initiated at the Wright plant by the requirements of the Army and Navy that materials such as steel be inspected in the



WRIGHT AERONAUTICAL CORPORATION

PATERSON, NEW JERSEY, U. S. A.

DATE May 12, 1928

MATERIAL SPECIFICATION NF-135

SAND CAST LOW COPPER DURALUMIN.

ANNULMENTS: This specification supersedes all previous specifications or letters of instruction covering this material.

FINISH: Castings must be true to pattern with correctly placed cores, free from blow-holes and brittleness caused by oxidized metal and free from hard spots. All castings requiring a water test shall stand a specified pressure without leaking. Castings not fulfilling these conditions are subject to rejection.

COMPOSITION: The material desired is a homogeneous alloy of the following composition:

Copper	2.25 - 3.0
Iron	1 - 1.5 (1 - 1.25 for pig)
Magnesium	.25 - .75
Aluminum	94 min.
Impurities Including Silicon & Manganese	1.0 max.

Castings or pig metal not conforming to the above chemical composition renders the shipment subject to rejection.

HEAT TREATMENT: Where so specified, castings should be heat treated as follows:

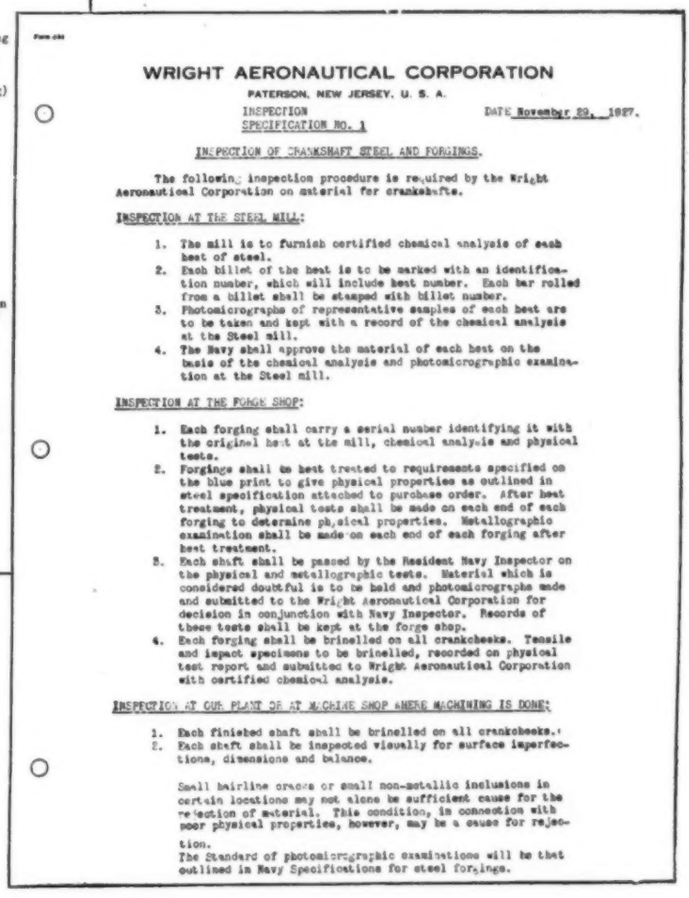
Heat to 950 - 975°F for 2 hours
Quench in water at 120°F or oil
Age 2 hours at 312°F

MINIMUM PHYSICAL PROPERTIES:

	Ultimate Tensile Strength Cast to Size Spec.	Elongation % in 2"
Un-heat treated	25,000	3.5
Heat treated	27,000	4.

REJECTION: Upon rejection of material, the shipment will be charged back to the manufacturer and held at his risk for a reasonable length of time, awaiting shipping instructions, the manufacturer to pay all transportation charges. It is understood and agreed that at any time within three weeks after a shipment is rejected, the manufacturer may claim a portion of the chips used in making the analysis for purpose of verification.

Fig. 1—Specifications are written out by the metallurgist for every material entering the product. The sample specification sheet here shown is intended to give the vendor an exact basis on which to make his bid, and cannot be altered by the purchasing department



WRIGHT AERONAUTICAL CORPORATION

PATERSON, NEW JERSEY, U. S. A.

INSPECTION SPECIFICATION NO. 1 DATE November 29, 1927.

INSPECTION OF CRANKSHAFT STEEL AND FORGINGS.

The following inspection procedure is required by the Wright Aeronautical Corporation on material for crankshafts.

INSPECTION AT THE STEEL MILL:

1. The mill is to furnish certified chemical analysis of each heat of steel.
2. Each billet of the heat is to be marked with an identification number, which will include heat number. Each bar rolled from a billet shall be stamped with billet number.
3. Photomicrographs of representative samples of each heat are to be taken and kept with a record of the chemical analysis at the Steel mill.
4. The Navy shall approve the material of each heat on the basis of the chemical analysis and photomicrographic examination at the Steel mill.

INSPECTION AT THE FORGE SHOP:

1. Each forging shall carry a serial number identifying it with the original heat at the mill, chemical analysis and physical tests.
2. Forgings shall be heat treated to requirements specified on the blue print to give physical properties as outlined in steel specification attached to purchase order. After heat treatment, physical tests shall be made on each end of each forging to determine physical properties. Metallographic examination shall be made on each end of each forging after heat treatment.
3. Each shaft shall be passed by the Resident Navy Inspector on the physical and metallographic tests. Material which is considered doubtful is to be held and photomicrographs made and submitted to the Wright Aeronautical Corporation for decision in conjunction with Navy Inspector. Records of these tests shall be kept at the forge shop.
4. Each forging shall be brinelled on all crankcheeks. Tensile and impact specimens to be brinelled, recorded on physical test report and submitted to Wright Aeronautical Corporation with certified chemical analysis.

INSPECTION AT OUR PLANT OR AT MACHINE SHOP WHERE MACHINING IS DONE:

1. Each finished shaft shall be brinelled on all crankcheeks.
2. Each shaft shall be inspected visually for surface imperfections, dimensions and balance.

Small hairline cracks or small non-metallic inclusions in certain locations may not alone be sufficient cause for the rejection of material. This condition, in connection with poor physical properties, however, may be a cause for rejection.

The Standard of photomicrographic examinations will be that outlined in Navy Specifications for steel forgings.

Fig. 2—Inspection specifications, such as here shown, are prepared by the metallurgist for all materials, and on the basis of these inspectors pass or reject the incoming material. In some cases the inspectors go to the steel mill and to the forging plant to inspect the material in process before it is received by the company

billet form in process of manufacture at the mill and in the mill forgings. This practice has been continued for the regular commercial steels and certain other materials, as it has been found to assure a dependable product. Arrangements are made for such mill inspection on the original specifications. Along the same lines the various characteristics of the vendors are studied by the staffs of the chief engineer and metallurgist so that it is possible in placing an order to take into account their comparative reliability and their proper equipment for the delivery of a consistently high-grade material.

Production materials used in the plant are of minor importance as far as concerns the ultimate finished product of the factory. But this does not mean that they are neglected or considered of minor importance in production economy. These materials may be called for by any department, but they must be passed on by the factory manager. The tests to which they are subjected are not as rigorous as those given to the direct materials, and usually consist of actual trials in the shop. As far as possible regular commercial standards are adhered to. When a new oil, cutting steel, or trade-named shop material comes to the attention of the purchasing agent through an advertisement or a salesman, a sample or limited quantity is procured for trial in the shop. It is then entirely up to the production department to decide whether or not the new material is to be substituted for one formerly used. The reverse process may also occur, in that the foremen or other shop executives may request the purchasing agent to obtain a certain material to replace one that is not giving entire satisfaction.

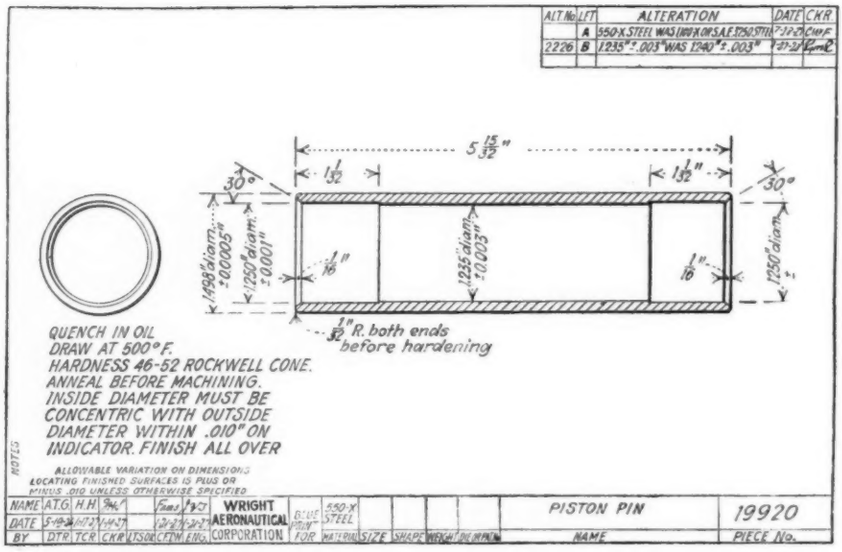

ALT. No. | LET. | ALTERATION | DATE | CK'R
2226 | A | 550-X STEEL WAS 1095 OR S.A.E. 1250 STEEL
B | 1235" ± .003" WAS 1240" ± .003"
5 15/32"
1 1/32"
1 1/32"
30°
30°
1.498" diam. ± .00005"
1.250" diam. ± .0001"
1.255" diam. ± .003"
1.250" diam. ±
1/16"
1/16"
1/32" R. both ends before hardening
QUENCH IN OIL
DRAW AT 500° F.
HARDNESS 46-52 ROCKWELL CONE.
ANNEAL BEFORE MACHINING.
INSIDE DIAMETER MUST BE CONCENTRIC WITH OUTSIDE DIAMETER WITHIN .010" ON INDICATOR. FINISH ALL OVER
NOTES
ALLOWABLE VARIATION ON DIMENSIONS LOCATING FINISHED SURFACES IS PLUS OR MINUS .010 UNLESS OTHERWISE SPECIFIED
NAME A.T.G. H.H.
DATE 5-19-37 12-27-37
BY DTR TCR CK'R LTS OR CF TW ENG.
WRIGHT AERONAUTICAL CORPORATION
BLUE PRINT FOR
550-X STEEL
MATERIAL SIZE SHAPE WEIGHT BLK. FIN.
PISTON PIN
NAME
19920
PIECE No.

Fig. 3—Sample of a drawing of an engine part showing the specification for the material treatment. The number 550 in the space marked "material" indicates the class of steel, the complete specification being filed under that number. The letter after the number indicates the treatment given the material. "X" is a special treatment marked on the drawing. Other treatments are standardized, and the specifications filed

In the process of procurement of materials it is recognized that the specification of the best material for a given condition and the inspection upon receipt of the material, are strictly technical jobs, and these functions are therefore handled by the respective engineering and inspection staffs. But the actual procurement in the market is done entirely by the purchasing department, whose function it is to know and tabulate proper sources of supply and arrange prices by competitive bids. The purchasing agent obtains his bids on the basis of written specifications. He cannot alter these to meet commercial materials, but if it is found that supplies can be had on a more commercial basis by slight alterations he refers the matter back to the engineering department. He remains in all cases the contact between the plant and the vendors.

Draftsmen's Error Contest

By Frank Kahn

THE greater the variety of product and the larger the organization, the greater the importance of the role the drafting room plays in the success of the enterprise. In large-scale operations, the bill of material on the drawing becomes a very important item and its correctness in every detail is essential. Unfortunately, the better the average draftsman is as a designer, the more he regards the bill of material as a necessary instrument of routine which follows the design as a sort of anti-climax. So if he happens to make an error or so in this purely routine matter (as he sees it), he doesn't see why that means very much, so long as his design is a good one.

Yet, it is these very errors that continually interrupt the smooth flow of production either in the shops or in the planning department, and occasion troublesome and expensive reissues of drawings to correct. When these errors are called to the draftsman's attention later, he not only resents being interrupted in his current design work, but he becomes unnecessarily antagonistic toward the planner or shop man who brings them to his attention. In fact, this attitude is too ingrained in the designer's make-up to be corrected satisfactorily by ordinary methods.

One large concern has reduced the errors arising from this source about 75 per cent by introducing a bill of material error-contest. A chart with the names of all the draftsmen is posted in the drafting room, and every time an error is reported and proved on a bill of material, a score is made against the draftsman's name. There are neither prizes nor penalties in this unique contest, it being dependent for its success solely upon the personal pride of the individual. It is surprising to note how even the most rabid "anti-routine" draftsman will switch about when he finds he is top score, or nearly so, and how he will begin to watch his bills of material more closely, with the consequent reduction of errors that inevitably follows this forcible method of emphasis on the importance of being careful.

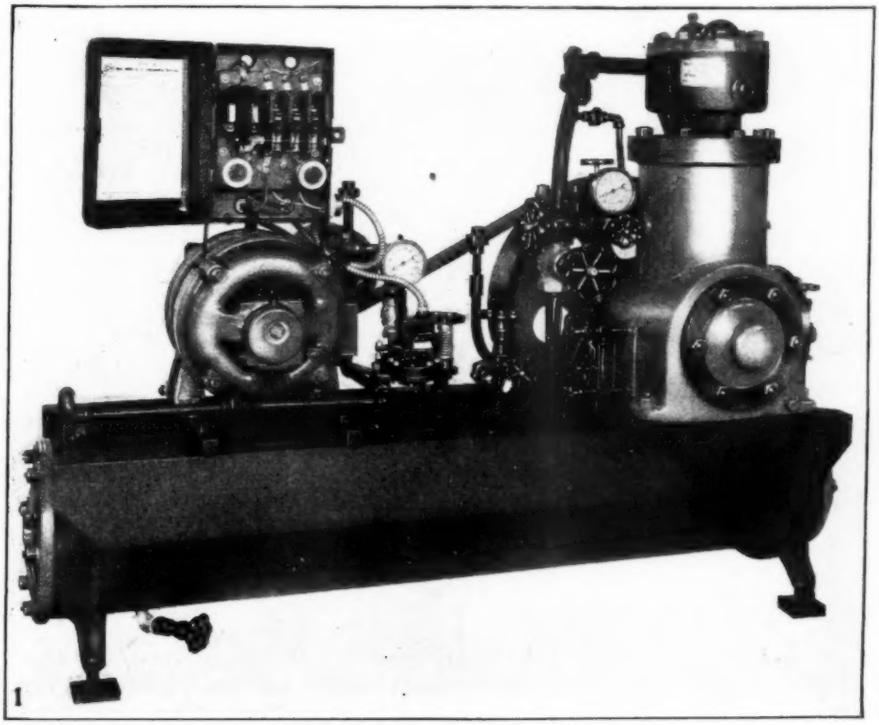
Welding Cuts Compressor Costs

By J. F. Lincoln
Vice-President Lincoln Electric Company

HIGH manufacturing costs have always been one of the limiting factors in the successful merchandising of small ammonia refrigerating equipment suitable for use in apartments, stores, hotels and restaurants. By using a refrigerant inferior to ammonia, a vast amount of refrigerating equipment has been marketed at prices so low that ammonia plants have been largely eliminated from competition in the small capacity field.

In what promises to be a successful effort to compete with a small ammonia plant, The Mansfield Ice Machine Company, Mansfield, Ohio, has developed a machine that weighs less than half as much as an equivalent machine of the older type, and occupies but 40 per cent as much floor space. Most of the economies were obtained by substituting arc-welded rolled steel for iron castings. The new design was perfected and patented by M. H. Ackerman of the Mansfield organization.

Such marked changes in design and construction of precision machinery are not effected over night but are the result of years of experience and are brought about by dint of hard work, intensive research and costly experiments. In the case of The Mansfield Ice Machine Company's product the changes in design and method of construction evolved slowly, each dependent on the other. One of the first refrigerating units manufactured by this company, as shown in Fig. 1, closely resembled older types of machines because of the large number of cast-iron parts. Arc welding was used at this stage only for making pipe connections to the condenser cylinder and for joining the cast iron supporting legs to the machine. Standard steel shapes, however, supplanted castings in the construction of the base for the motor, compressor and thermostatic control apparatus. However, the elimination of the stuffing box on the pulley shaft materially reduced the size of the unit so that it was possible to move it through a doorway 30 in. in width. This first model marked the beginning of the radical changes of design and methods of construction that have resulted in the machine which has recently been introduced to the market.



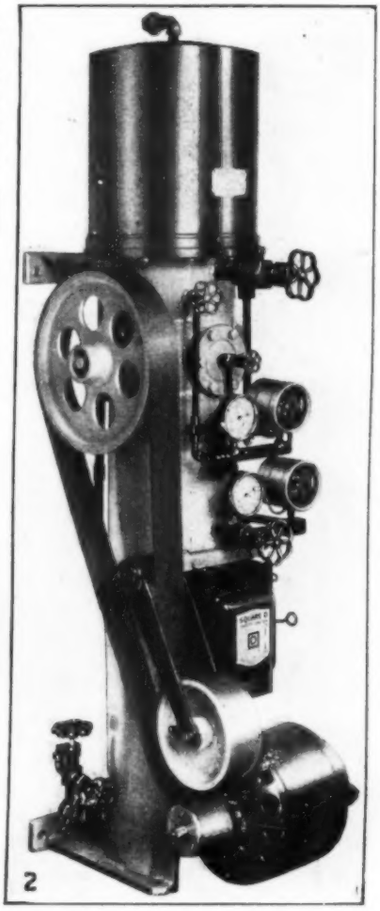


Fig. 1—One of the first machines built by The Mansfield Ice Machine Company. Arc welding was used on this machine only to make pipe connections to the condenser. Fig. 2—The complete ammonia refrigerating machine of all-steel construction. This model has an ice melting capacity from 1,100 to 3,000 lb., depending on the bore

The current model is built in various sizes, rated according to ice melting capacity. Because of the design and all-steel construction there are only slight increases in dimensions for the larger capacity machines. Units of 1,000 lb. to 3,000 lb. ice melting capacity are placed in a section of 10-in. steel pipe, from 3,000 lb. to 7,000 lb. ice melting capacity in a 12-in. steel pipe and from 7,000 lb. to 12,000 lb. ice melting capacity in a 14-in. pipe. One of the smaller machines is pictured in Fig. 2. This complete machine, ready to operate, weighs 780 lb., is 5 ft. 7 in. high, and occupies a floor space of only $3\frac{1}{2}$ sq.ft., the floor dimensions being 1 ft. $6\frac{3}{4}$ in. x 2 ft. 3 in. The compressor of this unit has a $1\frac{9}{16}$-in. bore and a 4-in. stroke. The unique design of the compressor permits the easy replacement of cylinders. The smallest unit's ice melting capacity may be increased to 2,000-lb. or 3,000 lb. by the installation of larger compressor cylinders and pistons without increasing the overall dimensions of the complete unit. For a 2,000-lb. unit the bore is increased to 2 in., and for 3,000 lb. capacity the bore is $2\frac{5}{16}$ in. Fig. 3 shows the method of holding the cylinders and cylinder head in place. By removing the six hold-down bolts the head and cylinders may be easily lifted from place. The lugs welded to the top cover plate of the pipe section, and into which the cylinder head bolts are screwed, are sections of round bar stock which have been drilled and tapped, the drilling and tapping operations being done of course before the lugs are arc-welded in place on top of the shell. Because cast-iron cylinder blocks are intricately cored castings whose percentage of rejection on account of porous metal is high, their cost is high. Aware of this and that cast iron would lend excess weight to the machine, The Mansfield Ice Machine Company now makes cylinders from standard stock, drawn seamless steel tubing arc-welded together. Three pieces of tubing of two sizes are welded together to make a rough cylinder which is machined to proper outside dimensions and then reamed and ground to finished inside dimensions. Simplicity of design of arc-welded steel compressor cylinders compared to their cast-iron predecessors is illustrated in Fig. 4. Although the compressor cylinder head looks like a cast iron cored job, it is a steel plate and square bar section arc-welded together as shown in Fig. 5. The cast-iron cylinder head which was replaced by the less costly welded steel head is shown at the right of the illustration. It is very difficult to obtain sound cored cylinder head castings as the cylinder head must be pressure tight up to 300 lb. per sq.in. The difficulties and vexations of casting losses are eliminated by the use of cylinder heads of welded steel construction. The problem of cooling the compressor cylinders, which in their welded steel construction have no water jackets, is solved simultaneously with the cooling of the counter-current condenser coil

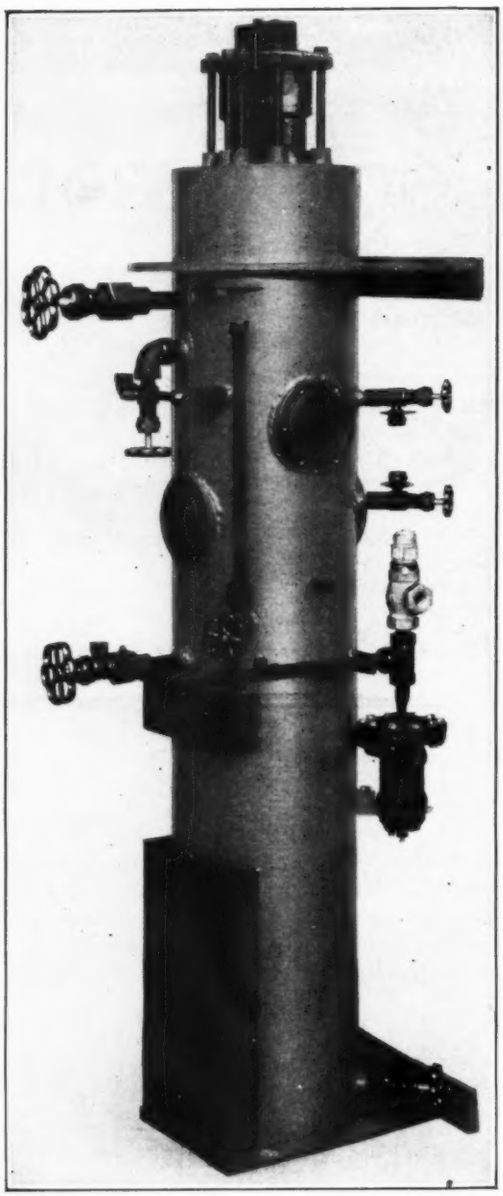
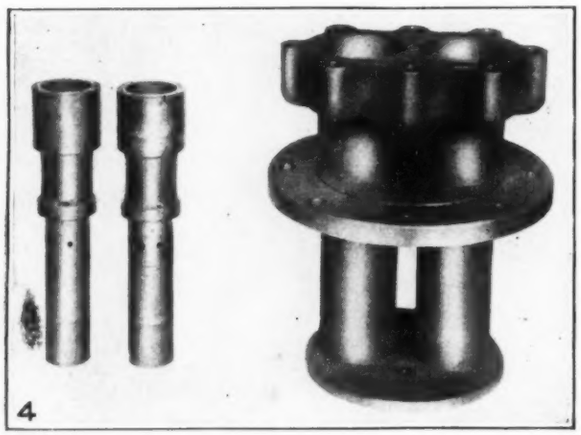


Fig. 3—Condenser and compressor housing showing the removable cylinders and cylinder head



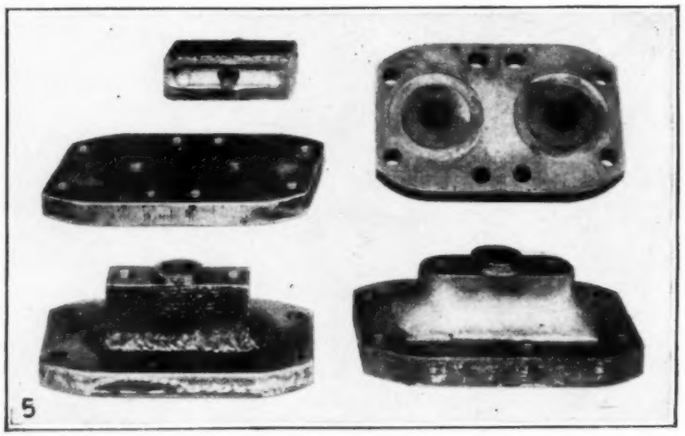


Fig. 4—Showing welded steel compressor cylinders and their cast-iron predecessors. Fig. 5—The arc-welded steel cylinder head is made from a piece of steel plate and a section of square bar stock. A cast-iron cylinder head which was replaced by welded steel construction is shown at the right in two positions

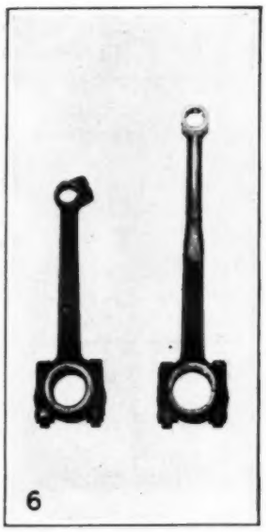


Fig. 6—Showing how a connecting rod for a small capacity condenser is made from a stock Model T Ford connecting rod.

Fig. 7—The connecting rod at the left cost $35.00 to make. The one at the left is made from a stock Fordson part at cost of only $3.00.

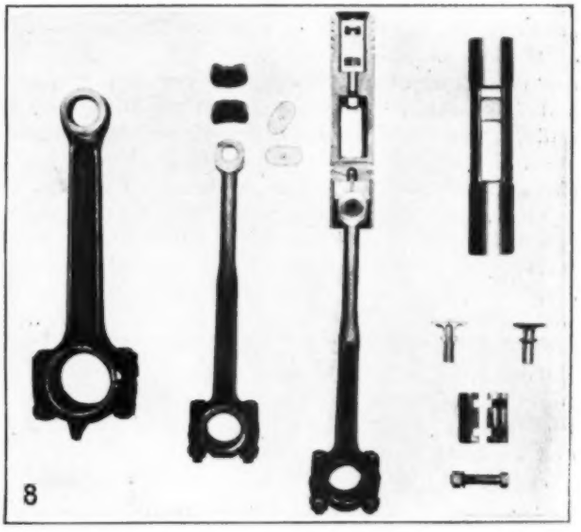


Fig. 8—Showing complete piston, valve and connecting rod assembly

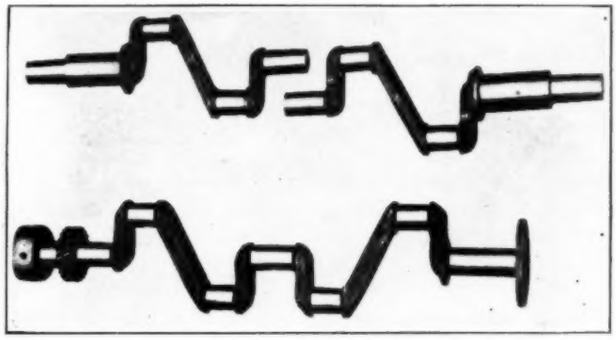


Fig. 9 — Two compressor crankshafts are made from a Ford crankshaft by use of arc-welded steel construction

which encircles the cylinders above the crank case. This is accomplished by enclosing the coil and cylinders with a water-tight welded steel shell into which water is automatically pumped keeping the coil and cylinders completely immersed at all times.

The economy of welded steel construction was found to be so great that it permitted a design which allowed the crank case bottom to be placed low enough so that an assembled piston and connecting rod can be removed and replaced through a hand hole in the crank case without disturbing the cylinder head assembly. In the conventional cast compressors, the connecting rods and pistons must be withdrawn upward through the cylinder bore after the removal of the cylinder head. This necessitates a large bore and short stroke. In many instances the unsatisfactory operation of small ammonia machines can be traced directly to the mechanical difficulty in reaching 165 lb. condensing pressure with a single-stage short-stroke compressor. It is a fact well known to those in the refrigeration equipment business that 4-in. bore and 4-in. stroke machines are very satisfactory whereas faulty performance appears in smaller capacity units—the smaller the unit the greater difficulty in obtaining consistent performance.

Another fact relating to the manufacture of satisfactory long-stroke machines of cast-iron construction is the prohibitive cost of small-bore and longstroke twin-cylinder compressors which at moderate speed will rate at 1,100 lb. ice melting capacity. A cast-iron compressor housing made for a satisfactory 4-in. stroke is nearly the size of a 4x4-in. compressor rated at three tons or more of ice melting capacity. This handicap coupled with the requirement for a large hole in the crank case through which the crank shaft must enter the cast housing, places limitations of design as well as prohibitive cost as serious obstacles to the success of small capacity ammonia refrigerating units of cast iron construction and with the necessary small-bore and long-stroke design to get volumetric efficiency.

Electric arc welding plays a prominent part also in the manufacture of the moving parts of this new type refrigerating machine. In the manufacture of connecting rods the electric arc transforms Model T Ford and Fordson connecting rods into connecting rods for the ammonia compressor. This change is accomplished by cutting off the wrist pin connections on the Ford and Fordson rods and arc welding an extension with the proper wrist pin connection for the compressor piston wrist pins. The connecting rod shown in the left of Fig. 6 is a Model T Ford part. At the right is the finished connecting rod for the small compressor in which a rod like the one at the right is used for the lower section. This utilization of Ford parts is most economical as the automobile and tractor parts can be purchased and altered at a cost far below that required by any refrigerating equipment manufacturer to forge the proper rods.

The altered Fordson piston rod (at right, Fig. 7) which is used in the ammonia compressor of a unit of 3,000 lb. ice melting capacity, superseded the rod in the left of the illustration because it has proved to be a more dependable rod and has a total cost of only $3.00 compared to a manufacturing cost of $35.00 for the older type rod. The wrist pin ends of the new type connecting rods are sections of drawn seamless steel tubing welded to the rods and then finished to proper size. A fin is welded to the lower half of the piston rod bearing for the purpose of throwing oil on the piston and cylinder walls of the compressor.

Besides the compressor pistons only one other part in the entire unit is made of cast iron. The complete piston, valve and connecting rod assembly and the com-

ponent parts are shown in Fig. 8. The sectional view of the assembly illustrates clearly the unique design of this part of the machine. By the use of a bronze shoe and shim, wear on the wrist pin bearing is reduced materially. The upper section of the piston shows the valve assembly in which the valve itself is the only moving part. Its weight is only three-quarters of an ounce.

The crank shaft of the ammonia compressor is another part whose manufacture has been made most economical by the use of electric arc welding. Two crank shafts are made from one Model T Ford crank shaft. This is accomplished by cutting the Ford part into halves, removing the flanges at the ends and welding suitable bearings and extensions on each end of the newly formed crankshafts. These are then machined to size. Fig. 9 shows a Ford crank shaft and two finished compressor crank shafts.

As stated previously in this article, the housing of a unit is a section of steel pipe which is divided into a compressor housing and an ammonia tank by the welding of pressure tight partitions of steel plate on the inside and at the ends of the steel pipe. Hand holes are cut in the housing at the bottom of the compressor crank case. Holes are also cut for the crank shaft and bearings and for pipe connections which are welded to the housing. The motor base is a standard channel section welded to the housing at its base. The base and wall brackets of the unit are made up of standard steel shapes arc-welded together and to the housing. The drive belt idler bracket is also made of arc-welded steel. In the piping necessary to connect the valves and gages all the permanent connections are made by the electric arc process. The equipment used in the welding department of the Mansfield Ice Machine Company includes Lincoln "Stable-Arc" welders manufactured by The Lincoln Electric Company, Cleveland, Ohio. It was in this company's school for training welder operators that Mr. Ackerman conceived the widespread possibilities of the use of arc-welded construction in the manufacture of his company's products.

What a Die Head Is Asked to Do

By C. W. Bettcher
Secretary, The Eastern Machine Screw Corporation

SO MUCH of the fine performance of modern machine equipment is taken for granted that it may not be out of place to call attention to what is expected of the self-opening die head as compared with what is required of other small tools used in the lathe or automatic screw machine. With drills, box tools, forming tools and other such, the feed per revolution of the stock can be set at say 0.010 in. or 0.015 in. per revolution or at any point where maximum efficiency seems to be obtained. With a die head, however, if the screw to be cut is to be 10 threads per inch, the chasers must advance at a rate corresponding to a feed of 0.100 in. per revolution or, if the pitch is 20, 0.050 in. per revolution, and there can be no other choice.

The depth and cross-section of material removed per revolution is fixed by the cross-section of the thread. For example, on a 10-pitch thread, the cross-section of material removed is that of a triangle 0.10 in. base, 0.064 in. altitude. The die head is expected to remove this excessive amount of material at a high number of surface feet per minute and at a rapid feed that is determined by the pitch of the screw.

The sides of the thread must make an included angle of 60 deg. in case of the U. S. form to an accuracy on each side of say 1 deg. plus or minus. The diameter of the thread, measured on the pitch lines, must be held to very close tolerances, usually only a few thousandths. The widths of flats, top and bottom, are also held within fairly close limits.

As regards lead accuracy, or number of threads per inch, the requirements are such that when the screw has been turned the required number of turns, the advance must be exactly 1 in. to within 0.002 in. plus or minus and this must be accomplished without the use of a lead screw. As a rule, the cam or motion that starts the die head onto the work only approximates the proper start after which the die head is expected to advance itself at the proper rate. More often than not, in maintaining this accurate lead, the die heads have to overcome considerable drag or friction in pulling up slides, turrets or spindles; this amount of drag varying considerably in different machines and corresponding to a resistence of a considerable number of pounds.

The length of thread must be controllable to close limits, i.e., the die head must trip at the desired point each time and this length of thread must be easily controlled by the operator through the adjustment provided.

In cutting a screw thread, the die head is expected to cut the thread straight from end to end with a taper less than 0.002 in., and this in spite of the fact that the machine may be somewhat out of line. Remembering that the chasers or blades in a self-opening die head must be free to open and close and cannot be clamped in position as is the case with a box tool or other similar tools, the fact that the die head meets this requirement of straightness day after day, year after year, under variable conditions, is quite remarkable. Although the die head has moving parts that must cause its chasers to open and close thousands of times a day, it is expected to close to exactly the same diameter each time, within 0.001 in., and always trip when the thread has been cut the required length.

It must be possible to remove one set of chasers and install another set in less than a minute and to make adjustment for diameter in even a shorter time.

When it is considered that the threads cut with die heads at extraordinary rates of production are expected to be as accurate, if not more accurate, than could be cut with a toolroom lathe, it can easily be seen what a marvelous tool the self-opening die head really is. In fact a die head may cut a thread in one second that would take a man on a lathe one hour, and yet with the same or a higher degree of accuracy.

The die head is expected to function year in and year out under a great variety of conditions, cutting millions of screws, and yet it seldom gets the attention and cleaning that such a high-grade tool deserves.

In view of the kind of work it is expected to turn out, and of the severe conditions under which it must function, it is not too much to ask that more than the usual consideration be given to keeping it properly adjusted, sharpened and carefully cleaned.

National Metal Exposition

PHILADELPHIA, OCTOBER 8 TO 12

In the following pages are given:

A list of exhibitors at the tenth annual National Metal Exposition.

Program of the technical sessions of the American Society for Steel Treating.

Program of the technical sessions of the American Welding Society.

Program of the technical sessions of the Institute of Metals Division of the A.I.M.&M.E.

Programs of shop inspection and entertainment.

Exhibitors · Products · Representatives

[Booth Numbers Follow Company Names]

— A —

ABRASIVE CO.—152.
Demonstration of grinding wheels running at high speed; display of grinding wheels, segments, bricks, and stones.
R. A. Shaffer, v.-p. and gen. mgr.; S. M. Hershey, sales mgr.; J. F. Fischer, asst. sales mgr.; H. O. Hunt, grinding wheel engr.; Earl Romary, grinding wheel demonstrator; W. A. Ruppel; I. R. Blair, and W. R. Ilko.

ACME ELECTRIC WELDER CO.—130.
A 6-kw. spot welder; and a 35-kw. spot welder with a 48-in. throat; also a butt-welding attachment.
Geo. M. Hessdoerfer, east. distributor.

AIR REDUCTION SALES CO.—129 and 131.
Airco 99.5 oxygen and acetylene in cylinders, oxygen discharge manifold, welding and cutting torches, regulators and supplies; the Radiagraph, motor driven and portable, for oxyacetylene cutting of steel plate, forgings, billets, risers, etc., for straight line and circle cutting and combinations of straight line and arcs or angles; No. 4 Oxygraph, for oxyacetylene cutting of light and heavy sections and production shapes; motor-driven tracing mechanism for following pattern or templets; No. 2 Camograph for reproduction cutting of shapes from steel plate.
W. W. Barnes, mgr., Phila. dist.; W. H. Eliason, A. T. Walker, D. C. Trout, W. L. Humphreys, H. B. Hand, and C. S. Peters, Phila. sales dept.; H. L. Rogers, asst. mgr., applied engr. dept., N. Y.; A. H. Yock and Fred Judelsohn, applied engr. dept., Phila.; F. E. Rogers, pub. mgr. and G. VanAlstyne, N. Y.; J. J. Crowe, research engr., Jersey City.

ALLEGHENY STEEL COMPANY.—118.
Samples of metal products and sheets, bars, tubes., etc., of heat-resisting Ascoloy.
C. B. Calomon, mgr. of Alloy sales; O. M. Otte, engr.; L. W. Hostettler, engr.; and W. R. Murphy, engr.

ALLEN STEEL CO., INC., EDGAR AND A. MILNE & CO.—300.
From A. Milne & Co.: tool steels, die, hollow-die, hollow-drill and auger drill steels, special sections; Lancashire iron and electrical iron; ball-bearing steel and ballwire; S. & C. Wardlow, Ltd., cutlery, gin-saw and hacksaw sheets; file sections; anvils; and hammers. From Edgar Allen Steel Co., Inc.: High-speed steels, turning and finishing steels; air-hardening, self-hardening and special-chisel steels; Red Label; tack-knife, die-casting, and production steels; tool steel; and drill steels.
Henry Sears Hoyt, member of firm, A. Milne & Co. and pres. Edgar Allen Steel Co., Inc.; J. King Hoyt, Jr., member of firm, A. Milne & Co., and sec'y-treas. Edgar Allen Steel Co., Inc.; V. A. Greene, v.-p. and gen. mgr.; Edgar Allen Steel Co., Inc., and sales mgr., A. Milne & Co.; R. P. Rice, G. K. Boland, A. E. Van Stone, E. B. Carnell and H. R. Adams, salesmen; Miss K. E. McDonald, private sec'y.; and B. Brower, warehouse supt.

AMERICAN BRASS CO.—97.
Welding demonstration and a line of Anaconda copper alloy welding rods for use as non-ferrous filler rods; demonstration using the acetylene torch.
W. H. Dowd, W. C. Swift, W. J. Maclean, John Becht, G. M. Hurlbut, J. H. Larmett, C. M. Saltsman and D. E. Hotchkiss.

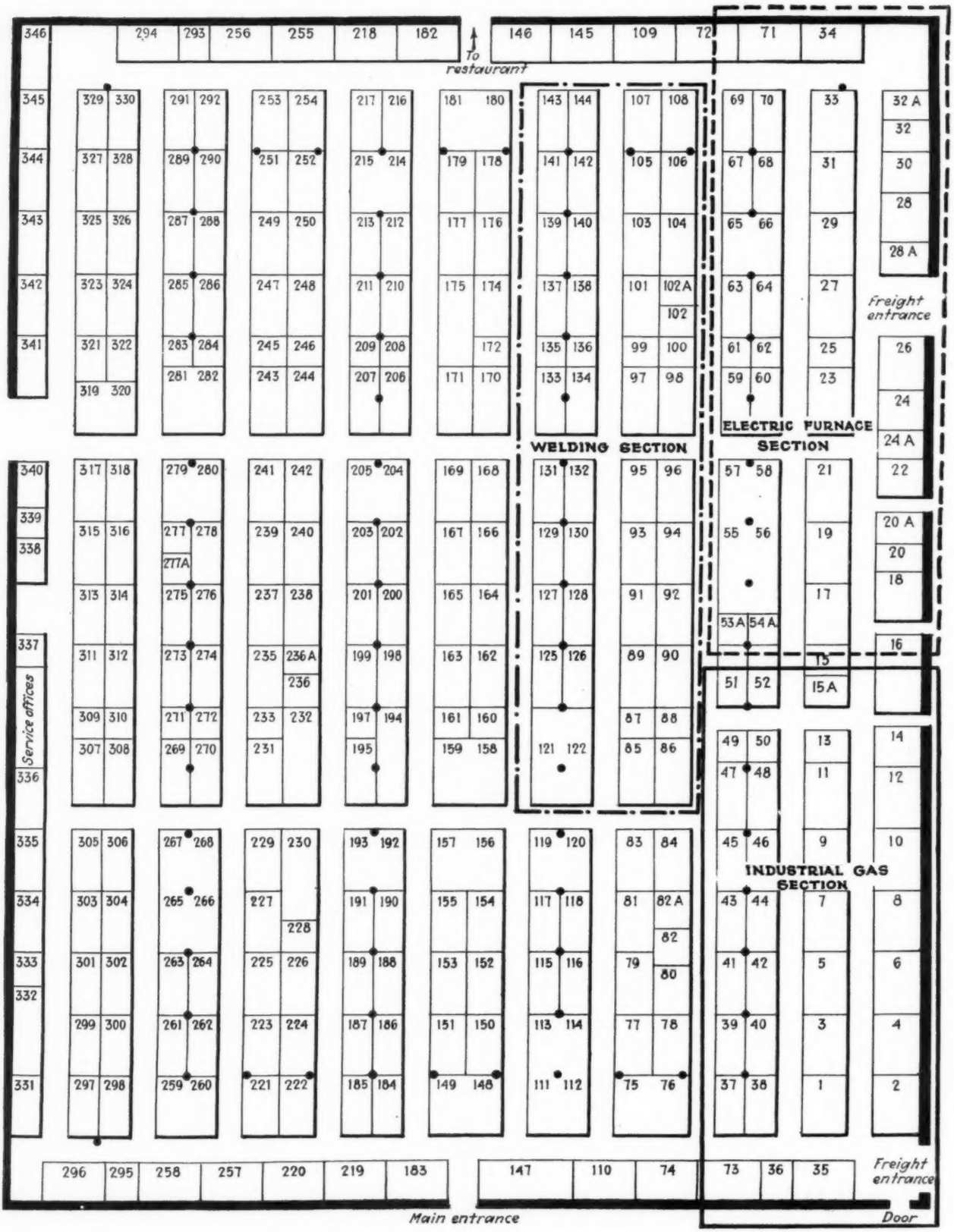
AMERICAN CAR AND FOUNDRY CO.—98.
No. 3 three-electrode Berwick electric rivet heater; No. 3 one-electrode, type E or forging, electric heater.
F. C. Cheston, John S. Helt.

AMERICAN GAS FURNACE CO.—A. G. A. Section.
Large size, rotary-retort carburizing machine having a capacity of 1,000 to 1,250 lb. of work per charge; a small rotary carburizing machine, capacity 75 to 100 lb. of work; a thermo-syphon heat exchange unit; for reheating and hardening, a large rotary retort type continuous heating machine, capacity 750 to 1,000 lb. per hr., also a reciprocating hearth type unit, capacity 100 to 200 lb. per hour; for drawing after hardening, a rotary retort bath type machine; rotary retort brass melter; oven furnaces for the annealing and hardening of carbon and high-speed steel; blowpipes, ribbon burners, tip burners for use in manufacturing glass bulbs, Neon light signs; a rotary plate singer for the singeing of cloth; also a heater for drawing cloth.
P. C. Osterman, v.-p.; John Mehrman, special rep.; Gustav Schwab, development eng.; Theodore Farwick, Sr., pyrometer and burner expert; Elmer C. Cook, adv. mgr., and F. W. Hornbruch, chief draftsman.

American Machinist—15.
Mason Britton, K. H. Condit, James A. McGraw, F. H. Colvin, L. C. Morrow, Fred S. Weatherby, W. E. Irish, G. S. Brady, F. J. Oliver, Jr., W. E. Kennedy, Ray Deen and W. H. Shipman.

American Metal Market—161.
Rudolph A. Langer, adv. mgr.; Samuel Glassford, circulation mgr.

Floor Plan of National Metal Exposition—Philadelphia, Oct. 8-12, 1928



AMERICAN METALLURGICAL CORPORATION—65 and 66.

"American" electric furnaces, 20-kw., 8x16-in. high-speed furnace, 8-kw. 6x10-in. salt bath, and 15-kw. 12x24-in. tool-room furnace; 10x18-in. round pot for lead, salt or cyanide; and 24x12x17-in. deep rectangular pot for lead, salt or cyanide; and 24x48-in. box furnace for carburizing, hardening and annealing.

K. A. Juthe, pres.; S. N. Juthe, v.-p.; A. J. Hanson, chief engr.; John C. Juthe, sales mgr.; A. B. Beach, L. A. Smith and A. D. Heath, dist. mgrs.; E. E. Bolds and A. A. Anderson, rep.

AMPCO TWIST DRILL COMPANY.—244.

Two automatic drilling machines requiring 50 sq.ft. and weighing combined 10,000 lb.; display of drills and reamers.

George Melling, inventor; Oscar Mon-

rad, pres.; W. E. Loy, gen. mgr.; F. J. Siborovsky, supt.; G. G. Chapman, Phila. rep.; David O'Brien, demonstrator, and Mr. McCumber, demonstrator.

ANDRESEN AND ASSOCIATES, INC.—18.
Fuels and Furnaces.
F. C. Andresen, pres.; F. I. Stanley Wishoski, managing ed.; W. N. Robinson, engr. ed.; Geo. W. Walter, engr. ed., and J. D. Zimmerman, adv. mgr.

ARMSTRONG-BLUM MANUFACTURING CO.—203.
Metal band saw, high-speed hacksaws, automatic high-speed saws, and high-speed edge hacksaw blades in operation.
Harry J. Blum, sec'y.; G. L. Hunt, mgr. Phila. office, and S. A. Woleben.

ARMSTRONG BROS. TOOL CO.—201.
Lathe, planer, and shaper tools; lathe dogs; clamps; ratchet drills; drop forged wrenches; pipe tools.
Horace Armstrong, sec'y. and sales mgr.; A. Arbogast; S. Welter, and G. L. Hunt.

ARMSTRONG CORK AND INSULATION CO.—24.
Insulating brick for furnaces, ovens, boiler settings, and other heater equipment; high-pressure covering, blocks and cement for steam and power plants, ovens, etc.; cork covering for refrigerated lines, brine and ammonia drinking water, etc.; and corkboard for the insulation of cold storage rooms and for the roofs of industrial buildings.
S. L. Barnes, adv. mgr.; H. B. Gates, asst. adv. mgr.; E. C. Hawley, John R. Livezey, M. A. Neely, F. L. R. Worley, Frank B. Blythe, H. J. Copestick, and F. S. Wallace.

ATKINS AND CO., E. C.—220.
No. 4 metal-cutting band-saw machine; power hacksaws; power hacksaw blades; slitting saws; circular and band saws, and machine knives.
Edward S. Norvell, mgr. metal-cutting dept.; L. C. Garvin, Phila. rep., and W. H. Sherer, Penn. rep.

AUTOMATIC TEMPERATURE CONTROL CO., INC.—174.
Automatic temperature-control equipment for gas, oil and electric furnaces, most of these controls in operation.
J. D. Andrews, sales mgr.; G. S. Frazee, Ohio rep.; R. C. Lawlor, West. Pa. and W. Va. rep.; R. A. Smart, Mich. rep.; C. Wilhjelm and G. H. Johanson, engr. staff.

— B —

BARNES CO. INC., W. O.—191.
Model L power hacksaw machine with light-socket motor cutting steels; and line of high-speed steel hacksaws.
W. O. Barnes, pres.; J. H. Flavell, sec'y.-treas.; F. M. Shaw, East. sales mgr.; C. B. Cecil, West. sales mgr.; C. G. Van Tuyl, Wm. Gross, Roy Schindler, rep., and F. L. Robertson, in charge of engr. dept.

BASTIAN-BLESSING CO.—128.
Oxyacetylene welding and cutting equipment; oxygen manifold; operating exhibit, and acetylene generator in section.
E. L. Mills, sales mgr.; E. N. Stevens, asst. sales mgr.

BELLEVUE INDUSTRIAL FURNACE CO.—68.
Several small heat-treating furnaces.
Walter E. Hihz, pres.; Louis J. Ravmo, sales mgr.

BELLIS HEAT TREATING CO.—720.
Electric furnaces heat-treating small tools and machine parts; hardening and tempering high-speed and carbon tool steels.
A. E. Bellis, pres.; J. W. Black, heat-treater and furnace engr.; R. C. Jordan, Phila. rep.

BETHLEHEM STEEL CO.—111 to 114.
Tool steels and stainless steel; alloy steels including an operating exhibit of silico-manganese spring steel; types of forgings and castings; structural steel sections; and miscellaneous products.
R. S. Tucker, mgr. of sales, alloy steels; W. R. Shimer, metallurgical engr.; Henry Wysor, metallurgical engr.; A. P. Spooner, engr. of tests H. G. Walton, gen. mgr. of sales; G. F. Hocker, mgr. sales, forgings, castings, etc.; C. C. Roscoe, mgr. of sales, tool steels; E. A. Buxton, asst. supt., tool dept.; G. P. Witteman, tool steel development engr.; H. C. Biggs, supt. tool steel dept.; T. G. Foulkes, W. C. Hartman, and A. McDonald, asst. research metallurgists; E. R. Long, supt. central tool dept.; W. B. Kennedy, mgr. of sales, Phila. dist.; J. H. Stoll, material engr., metallurgical dept.; M. W. Dalrymple, metallographist; W. E. Titus, salesman, Phila. dist.; W. S. Lippincott, salesman, Phila. dist.; H. E. Graffin, salesman, Bethlehem dist.; E. H. Jamison, salesman, Pittsburgh dist.; H. R. Weeman, salesman, Detroit dist.; J. D. Codding, salesman, Boston dist., and G. A. Cushman, salesman, Buffalo, dist.

BIAX FLEXIBLE SHAFT CO.—286.
Portable flexible shaft machines, flexible shafting, portable grinders, portable sanding machines, die-sinking and rotary filing machines.
R. Wezel, pres.; F. I. Vanderbeck, v.-p.; G. M. Vanderbeck, sec'y.-treas., and from Riter Brothers, M. Buchler and Mr. Riter.

BLAKESLEE AND CO., G. S.—299.
Pump-type cleaning machines for cleaning metal stampings, screw machine parts, castings, etc.; also two types of cleaning methods with different types of conveyors and spraying arrangements.
G. R. Blakeslee, pres.; John W. Dammers, sec'y.; A. T. Nogrady, East. sales engr., and A. S. Reichel and G. W. Anderson, sales engrs.

BOND CO., CHARLES—176.
Reeves variable-speed transmission; demonstration of gas welding and cutting apparatus manufactured by the Torchweld Equipment Co.
W. A. Slack, pres., Torchweld Equipment Co.; Charles Irwin, sales engr., Reeves Pulley Co. From the Charles Bond Co.; C. Carter Bond, mgr. director; L. R. McKean, sales engr., and T. A. Bergen, sales engr.

BOTFIELD REFRACTORIES CO.—59.
Intricate structures of fire brick bonded with firebrick cement, and demonstration of the Adamant gun.
W. B. Smith, salesman, middlewest; S. C. Lott, salesman, New England and Eastern Canada; Chas. C. Phillips, mgr. of N. Y. office; W. E. Tierney, salesman, South.; Jos. J. Sweeney, salesman, East., and A. H. Engstrom, sales mgr.

— C —

CAMPBELL, INC., ANDREW C.—264.
No. 0 nibbling machine cutting steel up to 14 gage; No. 1-A nibbling machine cutting steel up to $\frac{5}{16}$ in.; No. 2 nibbling machine cutting steel up to $\frac{3}{8}$ in.
Stuart Naramore, sales mgr.; J. Johnson, demonstrator.

CARBORUNDUM CO.—31.
Abrasive material, including crankshaft wheels for roughing and finishing, cam wheels, toolroom wheels, internal grinding wheels, centerless wheels; polishing grain, abrasive paper and cloth.
S. F. Courter, gen. sales mgr.; W. J. Griffith, dist. sales mgr.; G. E. Chorman, Boyd Work, and A. H. Prey, sales engr. dept.; G. T. Kretschmar, E. C. Maguire, H. L. Henszey, and J. F. Brady, Phila. representatives.

CARBORUNDUM CO.—33.
Small electric furnace to show the relative conductivity of silicon carbide, aluminum oxide, Fireclay tile; model demonstrating application of Carboradiant combustion chambers to car-type annealing furnaces; model of Carborundum decuperator; model of wire annealing furnace; refractories for high-temperature installations; and various grades of high-temperature cements.
C. E. Hawke, sales mgr.; and rep. as follows: John G. Fritzinger, Phila.; F. W. Miller, N. Y.; R. A. Beverley, Chicago; C. A. Dutton, Cleveland, and S. A. Fenno, gen. sales rep.

CELITE PRODUCTS CO.—52.
A line of heat-insulation materials including insulating concrete; demonstration furnace; also high-temperature cement, air-scaling and waterproofing compound for use on brick surfaces, and a workability agent for concrete.
Fred H. Emerson, East. div. mgr.; Angelo Gossman, asst. div. mgr.; Frank Coe, Phila. branch mgr.; W. T. Hulsizer, sales engr.; Walter Kennedy, steel plant rep., and C. M. Smith, adv. mgr.

CENTRAL ALLOY STEEL CORPORATION—158 and 159.
Early and modern automotive equipment; alloy steels; copper mo-lyb-den-um iron; stainless irons; and nitralloy.
B. F. Fairless, pres. and gen. mgr.; J. M. Schlendorf, v.-p. in charge of sales; C. C. Willits, Phila. dist. sales mgr.; M. J. R. Morris, ass't metallurgical engr., and staff of metallurgists.

CHAR PRODUCTS CO.—200.
Carburizing compounds, carbon-coated, pre-shrunk, and heat processed; also annealing carbon; lead-pot carbon, electrode carbon, and Reilly carbon.
C. B. Edwards, chem. engr.; C. Q. Swenson, spec. rep. and Wm. Higburg, sales mgr.

CHICAGO PNEUMATIC TOOL CO.—211.
Pneumatic and electric portable tools, drills, grinders, reamers, screw drivers, tapping machine, sanders.
A. E. Goodhue, v.-p., sales; L. J. Walker, mgr. electric tool sales; T. P. Harris, mgr. pneumatic tool sales, and A. M. Brown, dist. mgr.

CHICAGO STEEL FOUNDRY CO.—75 and 76.
Carburizing boxes, grids and pusher plates; pots for salt, lead and cyanide; furnace parts, retorts, camshaft-annealing tubes, oil-burner parts, chain and miscellaneous heat-resisting castings.
David Evans, pres.; Wm. J. Chapin, engr., and Jos. N. Bourg, J. F. Thompson, George O. Desautels and George M. Jeffery, sales rep.

CHROBALTIC TOOL CO.—288.
Heat-resisting, acid-resisting, and electrical-resistant-alloys; carburizing and annealing boxes, furnace parts, roller rails; and furnace hearths, retorts, pusher plates and trays; also miscellaneous alloy castings.
W. B. Sullivan, v.-p.; L. H. Whiteside,

Chicago; J. W. Mull, Jr., Indianapolis; A. A. Cash, Detroit; C. M. Conner, Phila.; E. A. Stifel, Murdoch and Co., Pittsburgh; W. C. Voss, Premier Machinery Co., Cleveland, and Louis C. Eitzen, N. Y.

CLEVELAND TWIST DRILL CO.—265.

Two high-speed drill presses demonstrating high-speed drills at various speeds and feeds; also a display of complete line.

H. P. Jenson, asst. mgr. of sales; H. A. Baier, plant engr.; T. Skove, asst. prod. supt.; D. Burdett, mech. dept.; and sales reps., H. G. Smith, F. M. Hoelzle, O. B. Hansen, G. Burkhardt, W. C. Weidig, R. G. Berrington, E. Horan, T. Thomas.

CLIMAX MOLYBDENUM CO.—163.

Molybdenum ore as it occurs, together with the concentrates produced from the ore and all the forms in which it is prepared for use.

B. F. Phillipson, pres.; F. C. Langenberg, v.-p. in charge of research; J. B. Thorpe, W. P. Woodside, and R. L. Rolf.

CLIPPER BELT LACER CO.—197.

Belt lacers, belt fasteners or hooks, belt cutters with safety feature and clipper connecting pins; 10-in. belt cutter and speed lacer; also the electric clipper ship, a scene-in-action display.

Carl P. Field, factory rep.

COATS MACHINE TOOL CO.—283.

Krupp gages; spring testing machine; micrometer fluid gage; Coats hand tachometers; Coats divided machine vises, and scale preventative.

Chas. E. Coats.

COOPER HEWITT ELECTRIC CO.—170.

Mercury-vapor lighting; displays also show the operation of Cooper Hewitt mercury switches used for the making and breaking of electric circuits.

C. F. Strebig, sales mgr.; R. B. Chipman, Phila. office; W. R. Flounders, Phila. office; D. R. Grandy, commercial engr.; L. F. Garisch, commercial engr. dept.

CRUCIBLE STEEL CO. OF AMERICA.—184, 185, 187 and 189.

Various grades of high-speed, special machinery steel, alloy and carbon tool steel, cold drawn specialties, stainless iron and steel, and non-corrosive steels.

B. F. Hufnagel, pres.; J. A. Matthews, v.-p.; A. T. Galbraith, v.-p.; J. M. McComb, v.-p.; H. L. Gellinger, auditor; R. Michener, gen. sales agent; R. E. Christie, W. K. Krepps, mgr. east. ry. dept.; J. P. Jayne, operating dept.; E. P. Gaffney, mgr. mach'y dept.; R. H. Heatley and branch mgrs. as follows: J. W. Barnett, Baltimore; F. J. Dawless, New Haven; W. H. Plage, N. Y.; Allan Fraser, Phila.; C. E. O'Connor, Syracuse.

— D —

DARWIN AND MILNER, INC.—225.

Line of alloy tool-steel products; display of dies and tools demonstrating quantity production; display of form tool castings and steel safety-razor blades.

Victor Tlach, pres.; John C. Koch, secy.; and John R. MacCracken and Charles F. Lear, rep.

DEARBORN CHEMICAL CO.—231.

A chemically compounded rust preventive; and powdered and liquid cleaners.

E. M. Converse, sales mgr.; C. A. Remsen, east. mgr.; and C. I. Loudenback, Detroit mgr.

DONNER STEEL CO.—173 to 175.

Display of cold-drawn material and parts made therefrom.

W. F. Vosmer, v.-p.; J. W. Donner, gen. supt.; A. G. Greenmayer, asst. gen. supt.; C. A. Cherry, asst. to v.-p. Dist. mgrs. as follows: H. G. Uphouse, Phila.; E. D. Pumphrey, Detroit; P. M. Guba, N. Y.; H. C. Richardson, Cleveland; R. E. Sherlock, and W. C. Peterson, metallurgical engrs.; L. C. Miller, J. W. Percy, F. H. Lammert, and N. F. Tisdale from the metallurgical dept.

DRIVER-HARRIS CO.—30.

Nichrome and other alloy castings and sheet containers for heat-resisting applications; and other products.

Dist. mgrs., Joseph B. Shelby, Phila.; W. E. Blythe, Detroit; J. C. Bilek, Chicago; Harry D. McKinney, gen. sales mgr.; George A. Lennox, asst. gen. mgr.; J. C. Henderson, foundry sales mgr.

— E —

ECLIPSE FUEL ENGINEERING CO.—A. G. A. SECTION.

Steam boiler complete with automatic-pump unit and condensation receiver; ½-hp. boiler, miniature; 4-hp. boiler with feed-water regulator and automatic fuel cut-off; (8x14) lead-hardening furnace; No. 3 high-speed steel furnace; automatic core-oven burner; centrifugal blowers; display of pressure steel and pressed alloy pots; single and compound injectors, burners, burner tips, inspirator type burners, etc.; demonstrating unit for tunnel burners with cooling wells; rivet heater with high-pressure proportional mixer; and blower with 5-hp. 20 a.c. motor for furnishing air.

O. M. Olsen, Walter Frederick, D. A. Campbell, J. M. Traugott, L. B. Maximom and G. W. McKee.

ELECTRIC FURNACE CO.—70.

Electric heat-treating furnaces and equipment; illustrations of unusual electric furnace installations.

R. F. Benzinger, v.-p.; F. T. Cope, ch. engr.; A. H. Vaughan, asst. ch. engr.; R. D. Thomas, Phila. rep.; E. P. Larkin, N. Y. rep.; F. J. Peterson, Detroit rep.; and S. Floyd Keener, T. B. Bechtel, and N. H. Knowlton, engrs.

ELECTRIC STEEL FOUNDERS' GROUP.—304 and 306.

Steel castings, small and medium sized.

R. A. Bull, director and C. N. Ring, asst. director, Electric Steel Founders' Research Group, Chicago; A. C. Jones, research engr., Lebanon Steel Foundry, Lebanon, Pa., and David Zuege, research engr.; Sivyer Steel Casting Co., Milwaukee.

ELECTRO ALLOYS CO.—119 and 120.

Alloy castings such as used in furnace construction, heat-treating equipment, heating machines, and oil burners.

H. P. Miller, A. M. Miller, Jr., W. J. Hansen, representatives; J. W. Henry, metallurgist; A. L. Garford, pres.; J. B. Thomas, treas., and W. C. Whyte, v.-p.

ELECTRO REFRACTORIES CORPORATION.—293.

Silicon-carbide brick, in various shapes; high-temperature cement; and Mag-No-Spall brick.

L. U. Milward, pres.; C. A. Asher.

ENDICOTT FORGING AND MANUFACTURING CO.—272.

Drop forgings and drop-forge products.

S. J. Marshall, pres.; G. B. Reed, salesman; T. B. Kelday, supt. and J. I. Smith, heat treater.

— F —

FALLS ELECTRIC FURNACE CORPORATION.—71.

Electric box-type furnace using Falls former full radiating sheet type units; sample unit sections and refractories.

H. J. McCauley, pres.; J. R. Eves, v.-p. and sales mgr.; C. M. Adams, Detroit eng. rep.; H. E. Trent, and J. V. Calhoun, Phila. eng. rep.

FERNER CO., R. Y.—202.

Precision-locating and jig-boring machine; micro-indicators, tubes and supports, and precision bench micrometers.

R. Y. Ferner, rep.; Charles T. Ameel, demonstrator; Ernest Stucky, demonstrator; John Cetrule, sales engr.; Nicholas Cetrule, sales engr.; and Peter Seibel, sales engr.

FINKL & SONS CO.—162.

Hot-work die steels; headers, grippers, etc., that have been in service; photos of plants and products.

C. E. Finkl, gen. mgr.; Fred Finkl, metallurgical engr.; I. C. Vance, sales; E. H. Graham, dist. sales mgr., Detroit; J. M. Curley, dist. sales mgr., New Eng.; W. H. Reiger, dist. sales mgr., Pittsburgh; T. P. Wallace, dist. sales mgr., Cincinnati.

FIRTH-STERLING STEEL CO.—167.

Exhibiting: Steels.

L. Gerald Firth, gen. mgr.; D. G. Clark, dir. of sales; Robert S. Stevick, works mgr.; G. J. Comstock, dir. of research; O. K. Parmiter, metallurgical engr.; A. S. Martin, engr.; C. G. Thoma, adv. mgr. Dist. mgrs. as follows: A. E. Barker, N. Y.; O. T. Smith, Boston; H. I. Moore, Hartford; E. T. Jackman, Chicago; G. A. Jacobs, Detroit; W. C. Royce, Cleveland; W. J. MacFarland, Phila.; J. V. Little, Phila. Salesmen, as follows: R. F. Kimber, F. N. Mead, I. Olsen, Harry Jarvis, Fred Jarvis, G. R. Bunting, J. Johnson, and W. A. Ruppel.

FORD CO., J. B.—229.

Samples of chemicals used in the cleaning of metals prior to finishing operations; also samples of cleaned work.

W. M. Cole, W. P. Scott, G. J. Lawrence and B. N. Goodell of industrial dept.

— G —

GAIRING TOOL CO.—265.

Multiple-operation standard and special cutting tools and tool holders; special types and combinations, multiple-operation tools of solid and inserted-blade type; nose drive reamer; full-floating holder; tap holder; counterbore set, offset spotfacting heads, chucking reamers, grinding fixtures; and counterbores and core drills.

E. Gairing, pres. and gen. mgr.; Clayton E. Wyrick, ch. engr.; B. O. O'Meara, sales engr.; D. J. Normoyle, Phila. rep.; E. T. Gropler, East. rep.; James Murray, Pittsburgh rep.; William S. Harvey, Syracuse and Buffalo rep.

GENERAL ALLOYS CO.—148 AND 149.

Heat-treating containers; carburizing and annealing boxes, cyanide, lead and salt pots, tubes and retorts, dipping baskets; furnace parts, retorts, muffles, rails, hearths, Hump furnace fixtures; bars, sheet, forged bolts, fabricated shapes, oil still parts, special valve parts, etc.

H. H. Harris, pres.; W. K. Leach, gen. mgr.; George C. McCormick, ch. engr.; Fred Blaney, gen. supt.; W. R. Blair, survey engr.; R. A. Alger, prod. fore-

man; J. C. Van Arman, asst. to the pres.; R. M. Kirk, mgr., N. Y. branch; Ralph Hare, New Eng. rep.; A. L. Grinnell, mgr., Detroit branch; J. J. Donovan, West. mgr., Chicago; W. A. Toohill, sales engr., Chicago branch; A. D. Heath, mgr., Indianapolis branch; and H. G. Chase, mgr., furnace division.

GOODELL-PRATT CO.—209.
Line of portable electric drills of various sizes; also a display of machinists' and precision tools.
F. W. Pratt, C. L. Jernberg, and Lee Fluke.

GOSS AND DE LEEUW MACHINE CO.—194 to 196.
Multiple-spindle chucking machine, 6-in., threading type, motor drive; and a 11-in. multiple-spindle chucking machine, threading type, motor drive; all in operation.

Stanley T. Goss, pres.; Val. C. Hart, sales engr.; J. J. Spring, sales engr.; H. J. Hauck, designing engr.; E. H. Peck, demonstrator, Swind Machinery Co., Phila. rep.

— H —

HOGAN CO., GEORGE J.—60 and 62.
Information covering line of oil, gas, electric and coal fired heat-treating furnace equipment; lists of installations, photographs, drawings and operating data.
R. E. Talley, pres.; C. F. Cone, J. L. Edwards, and A. D. Dauch, engrs.; and J. Sanberg, dist. mgr., Detroit and V. A. Hain, dist. mgr., Chicago.

HALCOMB STEEL CO.—186 and 188.
Types of products from various steel produced by this company.
F. B. Hufnagel, pres.; A. T. Galbraith, gen. mgr. of sales; S. T. Harleman, asst. sales mgr.; H. A. Pardee, gen. mgr.; H. J. Stagg, sales metallurgist; S. C. Spalding, wks. metallurgist; J. T. Leyden, service metallurgist; H. Barlow, mgr., N. Y. branch and A. Fraser, acting mgr., Phil.

HAYNES STELLITE CO.—143.
Oxweld acetylene torches, oxygen and acetylene tanks and hose connections to be used for demonstrating the stelliting process; stellited parts; tool bits, bar stock, welded tools, milling cutters; method of applying Haynes-Stellite welding rod to metal parts requiring resistance to abrasion.
W. A. Wissler, metallurgist; A. V. Harris, dist. sales; G. E. Wilson, sales rep.; A. S. Shiffert, sales rep.

HEPPENSTALL FORGE AND KNIFE CO.—195.
A 24-in. and a 10-in. octagonal ingot, which has been split through the center; also a small model shear, in operation.
C. W. Heppenstall, pres.; B. B. Weinberg, gen. sales mgr., Pittsburgh; C. J. Sauer, mgr., Heppenstall Forge Co., Bridgeport, Conn.; A. J. Porter, Jr., sales mgr., Heppenstall Forge Co., Bridgeport; J. A. Succop, research engr., Pittsburgh; D. A. Stuart, rep., Pittsburgh; G. I. Allen, rep., Cleveland; F. C. Moyer, rep., Detroit; A. L. Wurster, rep., Phila.; L. A. Daines, Chicago; C. G. Singleton, rep., N. Y.; G. O. Desautells, rep., Indianapolis, and O. W. Mueller, rep., Buffalo.

HEVI-DUTY ELECTRIC CO.—67.
General line of electric heat-treating furnaces.
E. L. Smalley, pres.; F. A. Hansen, gen. mgr.; W. B. Cooley, sales mgr.

HISEY-WOLF MACHINE CO.—334.
Electric tools as follows: Drills, screw drivers, nut setters, tool post grinders, angle plate grinders, combination external and internal grinders, vertical spindle grinders, bench grinders, floor grinders, bench buffers, floor buffers, combination disk and production grinders, and portable grinders.
H. W. Wallace, J. W. Friedlander and W. J. Holtmeier.

HOLCROFT AND CO.—84.
Moving pictures showing installations of Holcroft equipment.
H. L. Ritts, sec'y-treas.; C. H. Martin, C. E. Barba, B. G. Tarkington, Oscar Brophy, sales engrs.

HOSKINS MANUFACTURING CO.—69.
Ribbon-resistor electric furnace in operation. Display of Chromel resistance alloys and heat-resistant castings.
C. S. Kinnison, adv. mgr.; F. L. Zimmerman, dist. mgr.; W. A. Gatward, ch. engr.; W. D. Little, sales mgr.

HOUGHTON & CO., E. F.
A workshop depicting ancient and modern metallurgy; salt baths; Vim leather packings; lubricating oils; cutting oils; cylinder oils; core oils; carburizing materials; drawing compounds; rust preventative; cleaning materials.
George W. Pressell, W. A. Buechner, W. J. Wright, J. Coleman Bentley, E. H. MacInnis, E. C. Barlow, E. W. Bock, C. H. Reiss, C. G. Schultze, H. C. Finck, Fred J. Ramsey, Arthur Jenner, W. I. Schwarz, F. R. Dietrich, D. J. Richards, C. H. Schultz, Raymond W. Justice, John T. Taylor, C. H. Stonerod, J. Weber, H. Seward, F. A. B. Harris, F. V. Armato and John D. Powers.

HYDRAULIC TOOL WORKS.—310.
Portable hydraulic metal punches, punching $\frac{13}{16}$-in. holes in the flange of I-beams and $1\frac{1}{16}$-in. holes in the web of H-columns; and journal and thrust roller bearings.
Garrett F. Hom, and others.

— I —

IDEAL INDUSTRIAL MACHINERY.—153.
A 36x60-in. tumbling barrel with power loader and motor drive.
C. A. Albrecht, N. Y. rep.; George Walsh, New Eng. rep., and N. Ransohoff, gen. mgr.

ILLINOIS TOOL WORKS.—177.
Hobs, milling cutters, reamers, broaches, screw machine form tools, special tools and shakeproof lock washers.
P. J. Nelson, sales mgr., Illinois Tool Works; J. M. Gribbie, sales mgr., Shakeproof Lock Washer Co.; S. O. Bjornberg, consulting engr.; Wm. L. Battersby, rep., and E. C. Crowther, rep.

INTERNATIONAL NICKEL CO., INC.—219.
Typical application of nickel and nickel alloys, including nickel steel, nickel cast iron.
F. S. Jordan, sales mgr.; R. A. Wheeler, asst. sales mgr.; E. J. Bothwell, nickel dept.; A. J. Wadhams, mgr. development and research dept.; and P. D. Merica, asst. mgr., development and research dept.; and T. H. Wickenden, Charles McKnight, D. M. Houston, J. S. Vanick, F. B. Coyle, and J. W. Sands, from the development and research dept.

IRON AGE PUBLISHING CO.—183.
F. J. Frank, pres.; C. S. Baur, gen. mgr.; Emerson Findley, Central West. rep.; B. L. Herman, West. N. Y. State rep.; C. Lundberg, Phila. rep.; Pierce Lewis, Detroit and Cincinnati rep.; C. H. Ober, N. Y. rep.; W. B. Robinson, Pittsburgh rep.; W. C. Sweester, N. J. rep.; D. C. Warren, New Eng. rep.; F. S. Wayne, West. rep.; C. E. Lachaussee, St. Louis rep.; H. E. Leonard, O. Johnson, and B. H. Hayes, asst. to gen. adv. mgrs.; A. I. Findley, ed.; W. W. Mason, man. ed.; E. F. Cone, assoc. ed.; R. E. Miller, ed. staff; C. E. Wright, assoc. ed.; G. L. Lacher, assoc. ed.; S. G. Koon, assoc. ed.; E. E. Thum, assoc. ed.; T. H. Gerkin, ed. staff; G. S. Herrick, ed. staff; F. L. Prentiss, Cleveland ed.; G. F. Tegan, Pittsburgh ed.; R. A. Fiske, Chicago ed.; B. Finney, Cincinnati ed.; and A. H. Dix, mgr. reader service dept.

IRON TRADE REVIEW—79.
C. J. Stark, pres.; E. L. Shaner, ed.; E. F. Ross, assoc. ed.; E. C. Kreutzberg, East. ed.; G. O. Hays, East. mgr.; J. D. Pease, adv. mgr.; F. F. Light, circulation mgr.; H. M. Pickett, adv. mgr., *Steel Treaters' Daily;* J. D. Knox, assoc. ed. and B. K. Price, assoc. ed.

— J —

JESSOP STEEL CO.—237.
Steel sheets, samples of cold-rolled strip steel, tool-steel die exhibits, and stainless-steel sheet exhibits.
S. A. Grayson, pres.; F. T. H. Youngman, sec'y-treas.; A. G. Lambert, metallurgist; R. M. Paxton, Jr., mgr.; F. T. Morgan, Phila. rep.; and L. R. Samuels, spec. rep.

JONES AND LAUGHLIN STEEL CORPORATION.—230.
Hot-rolled and cold-finished Jalcase steel and parts made therefrom; various shapes, cold finished bars, light-weight channels and Junior beams, a new section of steel sheet piling, and other products.
W. B. Todd, mgr. cold finished sales; J. D. Allen, cold finished sales; J. S. Grumbling, metallurgical dept.; H. W. Graham, gen. metallurgist; J. H. Flaherty, metallurgist; W. R. K. Scott, metallurgist; T. C. Ham, dist. sales mgr., Phila.; William Miller, Phila.; C. S. Bradley, gen. mgr. of sales; and A. A. Wagner. From Edgecomb Steel Co.: Leslie Edgecomb, H. L. Beyer, W. J. Franklin, and H. N. Lutz.

— K —

KELLER MECHANICAL ENGINEERING CORPORATION—297 AND 298.
Automatic tool room machine, with attachment for locating and jig boring; and with double tracer rigging; Kellocater unit, with base, overarm and spindle; Keller cutter and radius grinder; line of Kellerflex machines.
P. C. Renno, salesman; Henry Schreiber, sales demonstrator; Harry Reichert, eng. and H. P. Loewenberg, sales engr.

KELLEY CO., J. W.—820.
Carburizing compounds, industrial oils, heat-treating salts, Green quenching and washing machine.
J. W. Kelley, pres., and H. B. Northrup, sec'y.

KELLEY REAMER CO.—155.
A line of adjustable boring and reaming tools including single-point tools, rigid-type boring bars, block-type boring and reaming tools, adjustable core drills, adjustable shell reamers.
E. W. Putnam, v.-p. and gen. mgr., and Haviland Wright, Phila. rep.

KEMP MANUFACTURING CO.—A. G. A. SECTION.
Burners and furnaces operating from

the Kemp automatic gas system; special furnaces; internally-fired lead baths, open-flame burners and display of gas burning under water.

Elmer B. Dunkak, sales mgr.; W. M. Ponder, sales rep.; and William Hunt, research engr.

KEYSTONE LUBRICATING CO.—296.

Pneumatic safety lubricating system; special greases for steel mill works; also lubricants for ball and roller bearings.

H. A. Buzby, pres.; C. O. Norstrum and H. M. Ludwick, lubricating engrs.; George W. Hall, Pittsburgh dist. mgr.; T. B. Little, steel mill rep., Pittsburgh; J. R. Lawrence and S. R. Marshall, Phila. rep.; and F. D. Street, sales eng. dept., Phila.

K-G WELDING AND CUTTING CO.—88.

K-G oxygen and acetylene regulator; welding, cutting, and a number of other torches.

Wm. D. Flannery, in charge; P. Noren; Wm. Munn; F. Leslie; H. Kress, Phila. rep.; Mr. Carr, Baltimore rep.

— L —

LAVA CRUCIBLE CO. OF PITTSBURGH.—19.

Line of refractories in standard brick, standard tile, special shapes, plastics, cements and graphite crucibles.

H. E. White, ceramic engr. and wks. mgr.; R. P. South, sales rep.; and F. South, Jr., gen. mgr.

LEEDS AND NORTHRUP CO.—214 and 215; 192 and 193.

(Furnace Exhibit, Booths 214 and 215). Hump hardening and Homo tempering furnaces.

G. W. Tall, Jr.; A. E. Tarr; W. A. Lane; W. C. Roxby.

(Pyrometer Exhibit, Booths 192 and 193) potentiometer pyrometers including models of automatic controllers, indicating controllers, temperature indicators, and recorders; optical pyrometers and portable indicators.

Henry Brewer; E. B. Estabrook; H. N. Michael; Earl Wood; Carl Parker.

LINCOLN ELECTRIC CO.—132.

Electric-arc welding equipment together with a display of various castings replaced by welded steel; a "Linc-Weld" motor together with a motor operating under water.

E. E. Lewis, welding demonstrator; O. P. Lang, Phila. dist. mgr.; J. W. Kenworthy, and E. J. Pfister, Phila. dist. rep.; D. C. Anderson, sales mgr.; and A. F. Davis, v.-p.

— M —

MAHR MANUFACTURING CO.—18.

Model of Mahr rotary forging furnace equipped with gas burners; Mahr blower; and line of Mahr oil burners.

W. G. Barstow, sales mgr.; C. F. Olmstead, asst. sales mgr.; R. M. Hortvet, engr.; D. H. Ruhnke, engr.; A. J. Nordenson, engr.; Ray W. White, N. Y.; G. A. Ledebur, Erie, Pa.; A. E. Stanzel, Detroit; Arthur Tenney, Troy, Ohio; C. W. Rudolph, and B. G. Harmon, Chicago; B. M. Brownell, H. B. Wilson Co., St. Louis.

MCCANN HARRISON CORPORATION—25.

One model of a continuous conveyor beam furnace.

H. B. McCann, pres.; Edward Busch, sales mgr.; and Charles L. Stewart, asst. sales mgr.

MCGILL METAL CO.—74.

Ball bearings, together with machine parts showing application of ball bearings; a machine for testing ball bearings.

Frank R. Schubert, v.p.; W. E. Brownell, treas.; T. L. Robinson, ch. engr.; and Wm. Scrimgeour, Washington dist. mgr.

METAL AND THERMIT CORPORATION—89.

Thermit welds, equipment for welding, etc.; also Carbidefree Alloys.

J. H. Deppeler, c. engr., N. Y.; Arthur F. Braid, sales mgr., Metals Dept., N. Y.; H. D. Kelley, dist. mgr., Pittsburgh; and R. L. Browne, dist. mgr., Boston.

MICHIGAN STEEL CASTING CO.—27.

High-temperature alloy castings, bars and sheets, carburizing boxes and tubes, cyanide pots, dipping baskets, rotary furnace retort; furnace parts such as rails and plates, and several types of pusher furnace trays and fixtures; alloy chain of several types; and alloy rolled bars and rolled sheets.

F. J. Stanley, gen. mgr.; E. D. Flintermann, sales mgr.; J. D. Corfield; W. E. Broadbelt; and J. C. Redmond, Phila. sales rep.

MICHIGAN TOOL CO.—240.

A line of hobs, shaper cutters, thread-cutting tools, milling cutters, side mills, special form tools, special cutters, inserted blade cutters, etc.

The Colonial Tool Co. will exhibit spline broaches, round-hole broaches, square-hole broaches, serration broaches, keyway broaches, connecting-rod broaches, in both pull and push types.

J. W. Mull, Jr., gen. sales mgr.; T. A. Oleck, Mich. rep.; C. M. Conner, Phila. rep.; E. O. Jenkins, Pa., and N. Y. rep.; T. A. Meyer and Chas. Peterson, Indianapolis office of J. W. Mull, Jr.

MILL AND FACTORY ILLUSTRATED.—160.

Harvey Conover, pres.; B. P. Mast, v.-p.; E. M. Stanley, adv. dir., and M. G. Farrell, ed.

MILNE & CO., A., AND EDGAR ALLEN STEEL CO., INC.—300.

From A. Milne & Co.: Tool steels, die, hollow-die, hollow-drill and Auger-drill steels, special sections; Lancashire iron and electrical iron; ball-bearing steel and ball wire; S. & C. Wardlow, Ltd., cutlery, gin-saw, and hack-saw sheets; file sections; anvils; and hammers. From Edgar Allen Steel Co., Inc.: High-speed steels; turning and finishing steels; air-hardening, self-hardening, and special-chisel steels; Red Label tack-knife, die-casting, and production steels; tool steels; and drill steels.

Henry Sears Hoyt, member of firm, A. Milne & Co. and pres., Edgar Allen Steel Co., Inc.; J. King Hoyt, Jr. member of firm, A. Milne & Co. and sec'y-treas., Edgar Allen Steel Co., Inc.; V. A. Greene, v.-p. and gen. mgr., Edgar Allen Steel Co., Inc. and sales mgr., A. Milne & Co.; R. P. Rice, G. K. Boland, A. E. Van Stone, E. R. Carnell and H. R. Adams, salesmen; Miss K. E. McDonald, private sec'y; and B. Brower, warehouse supt.

MILWAUKEE DIE CASTING CO.—198.

Various types of die castings in aluminum, zinc, lead, and tin; also samples which have been polished and plated; various assemblies to demonstrate the application of die castings; a die; also castings which were made in this die.

H. F. Schroeder, v.-p., and C. H. Frantz, sales engr.

MOLYBDENUM CORPORATION OF AMERICA.—115.

Nitrided steels, together with hardness testing machines to illustrate the hardness of these steels, etc.; malleable and gray-iron castings containing molybdenum.

G. M. Eaton, in charge of exhibit; William H. Phillips; E. J. Lowry, and Clifton Taylor, sales mgr.

MORSE TWIST DRILL AND MACHINE CO.—212.

Line of high-speed and carbon drills and reamers, taps, dies, screw-plate sets, and milling cutters.

F. O. Lincoln, v.-p. in charge of sales, and George M. Read, in charge of Phila. territory.

MUELLER BRASS CO.—83.

Brass and copper tubing; brass and bronze nickel-silver rod; brass, bronze and copper nickel-silver forgings; brass, bronze and nickel-silver screw machine parts; and brass and bronze sand castings; specialties as welding rod, brass and pipe fittings.

W. W. Roach, asst. sales mgr., mill products division; and B. F. Mueller, asst. sales mgr.

— N —

NATIONAL TWIST DRILL AND TOOL CO.—320.

Line of twist drills, milling cutters, reamers and hobs; some of the smallest twist drills in the world; an exhibit of drills with various types of points and the resultant damage to drills, as well as poor, inaccurate holes obtained.

Harry Butler, asst. sales mgr.; George Ringstad, adv. mgr.; J. J. Jordan, mgr. of N. Y. branch; E. W. Haines, mgr. of Phila. branch, and C. C. Cornwall, Pittsburgh rep.

— O —

OLSEN TESTING MACHINE CO.—269 and 270.

Cloudburst hardness testing machine and equipment for superhardening steel; Johnson hardness tester; Haigh alternate stress testing machine, Herbert pendulum hardness tester, Honda machine for testing cutlery, etc.; Olsen universal-testing machine; Olsen production-type Brinell-hardness tester as well as hand operated type; ductility testing machine for sheet-metal testing; the Olsen polishing machine; various extensometers, including the Olsen-Smith stress-strain recorder; the Olsen-Lundgren dynamic type of balancing machine, and the Olsen-Lundgren automatic weighing static-balancing machine.

Thorsten Y. Olsen, v.-p. Robert B. Lewis, Jacob Lundgren, and Bruce L. Lewis, engrs.

— P —

PITTSBURGH INSTRUMENT AND MACHINE CO.—284.

Hand- and power-operated Brinell testing machines; Brinell microscopes; sheet metal tester, and metallographic grinding machine.

Paul Kammerer, member of the firm, and Walter Kammerer, asst.

PORTER-CABLE MACHINE CO.—333.

Hi-speed production lathe; universal-milling attachment; horizontal disk sander; two-belt sander and grinder; hand sanders with bench stands; portable electric hand saw.

K. O. Ditmars, dist. rep., and D. J. Ridings, sales mgr.

POTTS & CO.—166.
Tools and dies made of various grades of tool steel; and machine parts made of heavy-duty constructional steels.
Arthur L. Collins, sales metallurgist; Henry R. Wimmersberger, Maurice H. Felty and L. D. Willis, sales rep.; A. W. Ainsworth; and Guy P. Bible, sales mgr.; also Thomas C. Potts, Charles Wm. Potts, J. J. Drexler, Claude Mengel, Stanley L. Bateman, and W. H. Dunlap.

PRODUCTION MACHINE CO.—210.
Polishing and finishing machinery; and centerless polishing and finishing machines.
W. S. Howe, pres.; A. H. Behnke, v.-p.; and Leon Kinsman, supt.

PYROMETER INSTRUMENT CO.—151.
Radiation, optical, immersion and surface pyrometers.
Richard C. Jordan, Phila. rep.; F. D. Heidorn, sales mgr.; O. Raab, metallurgical engr.

— R —

REINTJES CO., GEO. P.—15A.
Display of flat arch brick for use in high-temperature furnaces; also truss-arch shapes.
Geo. P. Reintjes, owner; S. Skouse, construction dept.; and John Hawkins, engr. dept.

ROCKWELL CO., STANLEY P.—80.
Laboratory remote-control Dilatometer on model furnace; an exhibit relating to metallurgical consulting service; also Dilatometer equipment in the booth of the E. F. Houghton & Co., and in the booth of the Peoples Gas Light & Coke Co.
Stanley P. Rockwell, pres. and treas.; Warren D. Fuller, v.-p.; Raymond W. Woodward, sec'y; and William A. Stumpf and Kenneth Stumpf, sales engrs.

ROESSLER AND HASSLACHER CHEMICAL CO.—262.
Plating deposits of Cad-a-loy, Duo zinc and copper; cyanide case hardening; sodium cyanide, cyanide mixtures and salts used in the heat treating trade; copper cyanide, zinc cyanide, and accessory chemicals used in the electro-plating industry; and specimens of case-hardened and electroplated work.
Walter M. Gager, metallurgist, in charge; Charles H. Proctor, electroplating expert; William J. Schneider, electroplating expert.

ROTOR AIR TOOL CO., Cleveland—22.
A line of portable pneumatic grinders and drills; demonstrations on grinding steel and steel welds with rubber and Bakelite bonded wheels; and the Rotor air sander.
K. L. Pohlman, v.-p. charge of sales; L. K. Berry, mgr. Phila. dist.; F. R. Moore, Phila. rep.; and G. O. Singer, N. Y. rep.

— S —

SCHERR CO., INC., GEORGE.—180 and 181.
Schuchardt and Schutte gear hobber, special worm miller, small automatic hobber and automatic hob grinder; line of Carl Zeiss optical measuring tools.
George Scherr, pres.; F. Konig, sec'y.; George Van de Plank, sales engr.; and George Kaner, service engr.

SENTRY CO.—64.
Sentry furnaces, as follows: Model H, model HS and model L.
A. A. Harvey, sales mgr. in charge; and P. B. Crocker, treas. and asst. mgr.

SHORE INSTRUMENT & MFG. CO.—236.
Scleroscopes, dial-type, and bulb-type, hardness tester for steels and materials; optical pyrometers; rubber testing instruments for hardness and elasticity of plastic materials; local-case and local-hard compounds used in the heat-treatment of steels for selective hardness; and a static test for hardness of steels and materials.
F. G. Kendall, sales mgr.; and J. M. Kendall, demonstrator.

SIMONDS SAW AND STEEL CO.—150.
Saws, machine knives, files, hacksaw blades, special tool steels, high speed steel, magnet and nickel steel and bullet proof steel plates.
C. R. Pafenbach, steel sales mgr.; and H. B. McDonald, metal saw supt.

SLEEPER AND HARTLEY, INC.—213.
One of a series of spring-coiling machines consisting of eleven different sizes.
P. Mignacca, spring and wire machine expert.

SMITH & SONS, INC., DAVID H.—223.
Combination punching and shearing machines; and billet shears.
William H. Krapohl, mgr. machinery sales; Dudley J. Smith, sales mgr.

SOUTHERN MANGANESE STEEL CO.
Assortment of heat- and corrosion-resistant alloys in the chrome-nickel series.
E. F. Mitchell, sales mgr.; W. M. Black, east. sales mgr.; J. T. Norris, N. Y. rep.; D. M. Powers, Cleveland rep.; F. A. Fahrenwald, consulting metallurgist; and A. W. Daniels, gen. sales mgr.

SOUTHWARK FOUNDRY & MACHINE CO.—217.
One 60,000-lb. testing machine; electric telemeter; strain gages; and Huggenberger tensometer.
H. A. Weaver, gen. mgr., Steel City Testing Laboratory; Francis G. Tatnall, mgr., testing equipment division, Southwark Foundry and Machine Co.

SPENCER TURBINE CO.—16.
Spencer turbo-compressors for supplying air in connection with oil and gas burning industrial furnaces, foundry cupolas, etc.
S. E. Phillips, pres.; F. A. Wright, dist. mgr.; F. D. Bailey, dist. rep. and O. J. Dingee, sales engr.

STANDARD ALLOY CO., INC.—19A.
Carburizing boxes, lead pots, normalizing and pack-heating furnace disks and spacers, enameling burning racks, heat-resisting conveyor chain grates, furnace trays and shoes, chimney pots, furnace parts and miscellaneous heat and acid resisting castings covering in general the heat treating and chemical field.
Frank F. Jackson, v.-p.; Harvey M. Smith, sales director; Emerson M. Williams, treas.; and J. H. Williams, sec'y; Charles D. Cutting, Detroit mgr.; and Herbert A. Cutting, sales engr., Detroit.

STANDARD TOOL CO.—199.
Twist drills, carbon- and high-speed reamers, taps, milling cutters, drill chucks.
W. P. Ross, sales mgr.; H. H. Polk, salesman; D. M. Dorsheimer, Jr., salesman; F. T. McGuire, salesman; C. C. Buck, metallurgist.

STARRETT CO., L. S.—248.
Micrometers, gages, indicators, rules, levels, calipers, dividers, hacksaw frames and steel tapes; high-speed and tungsten-steel hacksaw blades.
D. Moffat, Phila. rep.; A. H. Starrett, master mech.; D. Findlay, sales mgr.; and H. E. Masters, adv. mgr.

STEEL CITY TESTING LABORATORY—217.
Brinell testing machines, hand and power operated; portable hardness-testing hammer; sheet-metal tester; Brinell microscopes; and adapter for scleroscope.
H. A. Weaver, gen. mgr.

SURFACE COMBUSTION CO.—A. G. A. SECTION.
Heat-treating furnace with two-stage burners and automatic temperature control; small oven furnaces; standard forge furnace; varnish burner; circular cyanide hardening furnace; aluminum-melting furnace; crucible brass-melting furnace; display table of high and low pressure inspirators, several different types of burners; also pictorial display of recent installations.
Toledo office, F. W. Manker, v.-p., and C. B. Phillips, v.-p.; N. Y. office, C. A. Blesch, mgr., W. T. Fulton, Philip Kriegel, adv. mgr.; Phila. office, F. C. Starr, mgr., F. H. Trembley and K. H. Cree; Boston office, E. A. Weaver, mgr.

SWIND MACHINERY CO.—206.
A machine for fixture and jig work in the toolroom and which, in addition, lends itself to production work.
L. H. Swind, pres.; W. J. Powers, G. Helling, G. A. Marshall, W. C. Chapman, salesmen.

— T —

THWING INSTRUMENT CO.—276.
Line of thermoelectric pyrometers; inspector's calibrating and checking sets and millivoltmeters; recording pyrometer; radiation pyrometer tube; also resistance thermometers.
Charles B. Thwing, pres.; Edward J. Albert, sec'y; A. S. Hall, L. R. Driscoll, and P. P. Bourquin.

TRENT CO., HAROLD E.—71.
Electric-pot and trough type heat-treating furnaces for lead, salt or cyanide; direct-heat electric furnaces for steel-treating; melting pots for babbitt, solder, tin, etc.; and other electrically-heated industrial equipment.
H. E. Trent, pres.; J. V. Calhoun, sales mgr.; sales rep. C. M. Adams, J. R. Eves, and others.

TUTHILL PUMP CO.—277.
Line of rotary pumps for use in heat-treating departments or for general plant use; and the patented Tuthill packless pump.
O. L. Bock, sales rep.; and H. C. Osborne, chief engr.

— U —

UNA WELDING AND BONDING CO.—138.
Line of welders, both a.c., d.c. and d.c., d.c.; automatic welding head; line of welding rods.
Edward R. Alexander, E. W. Kronbach, A. A. Probeck, L. S. Burgett and J. B. Austin.

UNION MANUFACTURING CO.—239.
Chucks for the lathe, turret lathe, boring mill, planer, drill, brass workers; faceplate jaws and special chucks; also spur geared hoists, acme hoists, differential hoists, and trolleys.
E. I. Stevens, factory rep. in charge; J. V. Murphy, N. Y. rep.; H. H. Wheeler, treas.

UNIVERSAL STEEL CO.—164.

Sheets of carbon and alloy steels for hacksaw, gin saw, hand saw, circular saw, cutlery, magnet, high speed, agricultural disk and soft center steels; bars of carbon-, alloy- and high-speed tool steels, ball race, magnet, file and valve steels; sheet and bars of heat-resisting and non-corrosive steels and alloys, cold-drawn bars and cold-rolled sheets, hot-heading dies; and finished products made from the foregoing.

Representing Universal Steel Company, J. O. Rinek, asst. gen. mgr.; U. G. Miller, gen. supt.; Frank Garratt, sales metallurgist; H. M. German, metallurgist; Frank Saltsman, sales dept.; and H. G. Copp, metallurgical dept.

Representing Cyclops Steel Company, Charles Evans, gen. mgr.; F. F. Harter, dist. sales mgr.; and F. H. Cooke, Phila. rep.

— V —

VANADIUM-ALLOYS STEEL CO.—156 and 157.

Carbon, alloy and high-speed tool steels; typical tools made of tool- and high-speed steels; fractures of same; cold-drawn tool and high-speed steels; tools and dies which have given unusual production records.

R. C. McKenna, pres.; Floyd Rose, v.-p.; L. D. Bowman, wks. mgr.; J. P. Gill, metallurgist; R. B. George, metallurgical dept.; M. W. Caruthers, N. Y. rep.; W. R. Mau, Chicago dist. mgr.; D. L. Bardes, Pittsburgh rep.; F. W. Potts, Cincinnati dist. mgr.

VANADIUM CORPORATION OF AMERICA—257.

Ferro-vanadium; silico-vanadium; alumino-vanadium; vanadium metal, 95 per cent; ferro-chrome; ferro-silicon; and "Alsifer"; vanadium-steel railroad springs, valve springs, carbon-vanadium automobile crankshafts, forgings, etc.

Ward A. Miller, v.-p.; B. D. Saklatwalla, v.-p.; J. A. Miller, Jr., gen. mgr. of sales; H. T. Chandler, asst. to pres.; N. Petinot, asst. to pres.; G. L. Norris, chief metallurgical engr.; Jerome Strauss, chief research engr.; C. N. Dawe, mgr. automotive div.; C. B. Woodworth, mgr. west. div.; and G. A. Laub, asst. gen. mgr. of sales.

VAN DORN ELECTRIC TOOL CO.—292.

Working models of line of portable tools, electric drills, screw drivers, wrenches and grinders; tools suitable for operation on high frequency current; tapping tool; various sizes of reamers.

F. H. Zulauf, v.-p. and gen. mgr.; Lyman H. Bellows, gen. sales mgr.; S. S. Waters, and Louis Charnicky, sales dept.

VULCAN CRUCIBLE STEEL CO.—224.

High-speed, alloy and carbon tool steels; and special steels.

S. G. Stafford, pres.; R. M. Kelso; A. D. Beeken, Jr.; S. A. Stafford; W. H. Norris; C. E. Conway; Norman C. Einwechter, Phila. branch mgr.; W. F. Kline.

— W —

WELDING ENGINEER PUBLISHING CO.

H. S. Card, ed.; T. E. De Pew, east. mgr.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.—133, 134 and 135.

Line of welding equipment, including the 200-, 300- and 400-amp. arc-welding sets.

W. W. Reddie, section head, MG sets and welding sales; A. M. Candy, gen. mgr. dept.; and N. M. Norberg, welding demonstrator.

An electric furnace for lead or salt baths with a section cut away to show constructure; a match-vending novelty and a Delineascope showing installations to Westinghouse furnaces.

T. C. Kelley, mgr. industrial heating div.; J. C. Woodson, mgr. industrial-heating engr. dept.; F. G. Allen, C. W. Babcock, J. F. Baker, H. C. Bostwick; and L. C. Schweitzer of the sales dept.

WHEELING MOLD AND FOUNDRY CO.—299.

Section of chilled-iron sheet mill roll, section of alloy-steel heat-treated roll; section of Wheeling metal roll, alloy-steel heat-treated forging die, and alloy-steel hammer ram.

H. E. Field, pres.; E. A. Balsley, v.-p.; R. C. Heaslett, metallurgical engr.; and Craig Adair, salesman.

WHEELOCK, LOVEJOY AND CO., INC.—147 and 110.

Alloy machinery steels; tool steels in their application to special parts; replica of open hearth furnace in operation.

A. Oram Fulton, pres.; F. H. Lovejoy, v.-p.; E. C. Bartlett, Cleveland mgr.; S. W. Parker, Chicago mgr.; C. F. Jenks, Cleveland sales dept.; A. L. Knight, A. F. Erikson and H. B. Briggs, Cambridge sales dept.; H. M. Foster, G. S. Longley, and T. W. Knight, N. Y. dist.

WHITNEY METAL TOOL COMPANY—273.

Hand metal-working punches, shears, and angle-iron machinery.

John Jenson, sec'y and mgr.; Gus Jensen, sales rep.

WIEDEMANN MACHINE CO.—236A.

Photographs of plant and various operations.

Theodore Wiedemann, pres.; Henry Bockrath, v.-p.; Jos. H. Bockrath, sec'y.; and Otto F. Wiedemann.

WIEGAND CO., EDWIN L.—71.

Line of Chromalox products, such as strip heaters; space heaters; immersion units; complete electric heaters; automatic electric water heaters, etc.

Ernest N. Calhoun, sales mgr.; sales rep. C. M. Adams, H. E. Trent, and J. V. Calhoun.

WILLIAMS & CO., J. H.—226.

Drop-forgings, for automobiles, airplanes, etc.; drop-forged wrenches from chromium-molybdenum and plain carbon steel; monkey wrenches, bull-dog wrenches, drop-forged clamps, crank handles, eye bolts and hoist hooks.

J. C. Scanlon, gen. sales mgr., special forgings; Philip Rigby and Walter Linde.

WILSON-MAEULEN CO., INC.—78.

Automatic temperature controllers; recording pyrometers; indicating pyrometers; Rockwell hardness testers, indicating resistance thermometers and recording resistance thermometers.

G. B. Duff, engr. dept.; and W. Printz, N. Y. rep.

WILSON WELDER AND METALS CO.—95.

Welding machines; the Wilson Color-tipt welding wire; also Wilson welding accessories.

T. B. Hasler, pres.; E. D. Bransome, v.-p.; Alexander Churchward, tech. director; L. A. Quarmby, sales mgr.; Harry Schemm, demonstrator.

PROGRAMS

Technical Meetings · Plant Visits · Entertainment

A.S.S.T. Technical Program

Monday, A.M.

Benjamin Franklin Hotel

AN INVESTIGATION OF THE PHYSICAL PROPERTIES OF CERTAIN CHROMIUM-ALUMINUM STEELS, by Frank R. Lounsberry and Walter R. Breeler, Atlas Steel Corporation, Dunkirk, N. Y.

CHROMIUM-COPPER STEELS AS POSSIBLE NON-CORROSIVE FERROUS ALLOYS, by B. D. Saklatwalla and Albert W. Demmler, Vanadium Corporation of America, Bridgeville, Pa.

A NEW DEVELOPMENT IN CORROSION-RESISTING STEEL, by Frank R. Palmer, Carpenter Steel Co., Reading, Pa.

STAINLESS IRON AND ITS APPLICATION TO THE MANUFACTURE AND TRANSPORTATION OF NITRIC ACID, by Walter M. Mitchell, Central Alloy Steel Corporation, Massillon, Ohio.

Monday, P.M.

Assembly Room, Commercial Museum

SURFACE HARDENING OF SPECIAL STEELS WITH AMMONIA GAS UNDER PRESSURE, by Raymond H. Hobrock, Engineering Experiment Station, Purdue University, Lafayette, Ind.

METHODS OF APPROXIMATING CERTAIN PHYSICAL CHARACTERISTICS OF NITRIDED STEEL CASES, by G. M. Eaton, Molybdenum Corporation of America, Pittsburgh.

DEPTH AND CHARACTER OF CASE INDUCED BY MIXTURES OF FERRO-ALLOYS WITH CARBURIZING COMPOUNDS, by E. G. Mahin, University of Notre Dame, South Bend, Ind., in collaboration with R. C. Spencer, Caterpillar Tractor Co., Peoria, Ill.

SOLUBILITY OF CARBON IN NORMAL AND ABNORMAL STEELS, by Oscar E. Harder, University of Minnesota, Minne-

apolis, Minn., and Willard S. Johnson, American Rolling Mill Co., Middletown, Ohio.

Tuesday, A.M.

Ball Room, Benjamin Franklin Hotel

THE EQUATION OF THE CARBON TIME CURVE IN BASIC OPEN-HEARTH REFINING AND PREDICTION OF CARBON DROP, by Alexander L. Feild, Union Carbide and Carbon Research Laboratories, Inc., New York City.

A MELTING RECORD OF THREE ACID OPEN-HEARTH HEATS, by W. E. Griffiths, Union Carbide and Carbon Research Laboratories, Inc., Long Island City, and C. E. Meissner, Chrome Steel Co., Carteret, N. J.

MANUFACTURE OF ACID OPEN-HEARTH STEEL FOR FORGING INGOTS, by H. P. Rassbach, Midvale Co., Nicetown, Philadelphia.

DEOXIDATION OF STEEL WITH SILICON, by Dr. C. H. Herty, Jr., and G. R. Fitterer, United States Bureau of Mines, Pittsburgh.

Tuesday, P.M.

Assembly Room, Commercial Museum

GRAPHITIZATION IN THE PRESENCE OF NICKEL, by H. A. Schwartz, National Malleable and Steel Castings Co., Cleveland.

INFLUENCE OF NICKEL ON COMBINED CARBON IN GRAY IRON, by J. R. Houston, the Harnischfeger Corporation, Milwaukee, Wis.

SOME CHARACTERISTICS OF PEARLITE IN EUTECTOID RAIL STEELS, by O. V. Greene, Reading Co., Reading, Pa.

CUTTING QUALITIES OF AN ALLOY STEEL AS INFLUENCED BY ITS HEAT TREATMENT, by O. W. Boston, University of Michigan, Ann Arbor, Mich., and M. N. Landis, Landis and Landis, Chicago, Ill.

Wednesday, A.M.

Ball Room, Benjamin Franklin Hotel

Annual meeting of the American Society for Steel Treating. CAMPBELL MEMORIAL LECTURE, by Dr. W. H. Hatfield, Sheffield, England.

Wednesday, P.M.

Assembly Room, Commercial Museum

NOTES ON SMOOTHING AND ETCHING, by H. B. Pulsifer, the Beryllium Corporation of America, Cleveland.

FURTHER OBSERVATIONS ON THE MICROSTRUCTURE OF MARTENSITE, by Francis F. Lucas, Bell Telephone Laboratories, New York City.

TREATMENT AND STRUCTURE OF MAGNESIUM ALLOYS, by John A. Gann, Dow Chemical Co., Midland, Mich.

NEUMANN BANDS IN FERRITE, by C. H. Mathewson, Professor of Metallurgy, Yale University, New Haven, Conn.

A STUDY OF THE CONSTITUTION OF HIGH MANGANESE STEELS, by V. N. Krivobok, Carnegie Institute of Technology, Pittsburgh.

Thursday, A. M.

Ball Room, Benjamin Franklin Hotel

ON OXYGEN DISSOLVED IN STEEL AND ITS INFLUENCE ON THE STRUCTURE, by M. A. Grossmann, Central Alloy Steel Corporation, Canton, Ohio.

SURFACE COOLING OF STEELS IN QUENCHING, by H. J. French, G. S. Cook and T. E. Hamill, Bureau of Standards, Washington, D. C.

TUNGSTEN CARBIDE, A NEW TOOL MATERIAL, by S. L. Hoyt, General Electric Co., Schenectady, N. Y.

AUSTENITE DECOMPOSITION AND LENGTH CHANGES IN STEEL, by Edgar C. Bain, U. S. Steel Corporation, Kearney, N. J., and Willis S. N. Waring, Union Carbide and Carbon Research Laboratories, Long Island City, N. Y.

ON THE NATURE OF MARTENSITE CRYSTALS, by Dr. Kotaro Honda, Tohoku Imperial University, Sendai, Japan.

Thursday, P.M.

Assembly Room, Commercial Museum

TORSIONAL MODULUS OF CARBON STEEL, PHOSPHOR BRONZE, BRASS AND MONEL METAL, by William P. Wood, University of Michigan, Ann Arbor, Mich.

SILICON-MANGANESE STEELS WITH CHROMIUM ADDITIONS FOR ENGINEERING APPLICATIONS, by A. B. Kinzel, Union Carbide and Carbon Research Laboratories, Long Island City, N. Y.

EVALUATION OF THE STABILITY OF METALS AT ELEVATED TEMPERATURES FROM EXPANSION AND SHORT-TIME TENSILE TEST DATA, by Albert E. White and Claude L. Clark, University of Michigan, Ann Arbor, Mich.

CLOUDBURST PROCESS FOR HARDNESS TESTING AND HARDENING, by Edward G. Herbert, Edward G. Herbert, Ltd., Manchester, England.

Friday, A.M.

Ball Room, Benjamin Franklin Hotel

METALLURGICAL PROBLEMS OF TRANSMISSION GEARING, by Ernest F. Davis, Warner Gear Co., Muncie, Ind.

DECARBURIZATION OF HIGH CARBON STEEL IN REDUCING ATMOSPHERES, by J. J. Curran and J. H. G. Williams, Henry Souther Engineering Co., Hartford, Conn.

SERVICE ANNEALING OF SLING AND CRANE CHAINS, by W. J. Merten, Westinghouse Electric and Manufacturing Co., East Pittsburgh.

HIGH CARBON, HIGH CHROMIUM STEELS, by J. P. Gill, Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL FAILURES IN AIRCRAFT, by F. T. Sisco, Wright Field, Dayton, Ohio.

ON THE EQUILIBRIUM DIAGRAM OF THE IRON-MOLYBDENUM SYSTEM, by Takeshi Takei and Takejiro Murakami, Tohoku Imperial University, Sendai, Japan. (By title)

Friday, P.M.

Assembly Room, Commercial Museum

EFFECT OF FURNACE ATMOSPHERES ON STEELS, by R. G. Guthrie, Peoples Gas Light and Coke Co., Chicago.

PROGRESS MADE IN THE USE OF ELECTRIC FURNACES FOR HEAT TREATING, by A. N. Otis, General Electric Co., Schenectady, N. Y.

A NEW METHOD FOR HEAT TREATING HIGH SPEED STEEL, by Horace C. Knerr, Consulting Metallurgist, Philadelphia, Pa.

HEATING HIGH SPEED STEEL TO 2,400 DEGREES FAHR. IN MOLTEN LEAD, by Wilbur C. Searle, Leland Gifford Co., Putnam, Conn.

American Welding Society Technical Program

Tuesday, A.M.

Bellevue-Stratford Hotel

WELDING IN HEATING, VENTILATING AND PLUMBING INDUSTRY, by R. A. Jack, *Domestic Engineering.*

TESTING JOINTS FOR AIRCRAFT STRUCTURES PREPARED UNDER PROCEDURE SPECIFICATIONS, by H. L. Whittmore, Bureau of Standards, Washington, D. C., and H. H. Moss, Linde Air Products Co.

Tuesday, P.M.

Commercial Museum

WELDS AT ELEVATED TEMPERATURES, by Professor C. Moser, Leland Stanford University.

FORMULA FOR COMPUTING DESIGN STRESSES FOR PRESSURE VESSELS, by S. W. Miller, Union Carbide and Carbon Research Laboratories.

Wednesday, A.M.

Bellevue-Stratford Hotel

RUNNING A SUCCESSFUL JOB WELDING PLANT, by J. S. Oechsle, President Mataweld, Inc.

WELDING IN THE AUTOMOBILE INDUSTRY, by J. W. Meadowcroft, Assistant Works Manager, Edward G. Budd Manufacturing Co.

Thursday, P.M.

Commercial Museum

DESIGN OF WELDED STRUCTURES, by F. P. McKibben, Consulting Engineer, General Electric Co.

ERECTING A BUILDING BY WELDING, by J. F. Lincoln, Lincoln Electric Co.

OXY-ACETYLENE CUTTING IN THE STRUCTURAL FIELD, by H. E. Rockefeller, Linde Air Products Co.

Friday, A.M.

Bellevue-Stratford Hotel

SPECIAL FILM ON STUDIES OF THE METAL ARC, by Dr. Karl Bung, German Engineer.

DESIGN OF MACHINERY PARTS BY USE OF WELDING OF STEEL SHAPES, by Messrs. Hague, Marthens and Brinton, Westinghouse Electric and Manufacturing Co.

A.I.M. Technical Program

Tuesday, A.M.

Benjamin Franklin Hotel

LESS COMMON ELEMENTS IN THE ELECTRICAL INDUSTRY, by T. S. Fuller.

GASES IN CASTING COPPER, by O. W. Ellis.

DIFFUSION OF ZINC INTO COPPER, by S. L. Hoyt.

CONSTITUTION OF THE COPPER SILICON SYSTEM, by C. S. Smith.

Wednesday, P.M.

JOINT SESSION with the American Society for Steel Treating.

Thursday, A.M.

Benjamin Franklin Hotel

EFFECT OF COLD ROLLING AND HEAT TREATMENT UPON THE PHYSICAL PROPERTIES OF BRITANNIA METAL, by B. Egeberg and H. B. Smith.

STABILITY OF ALUMINUM AND MAGNESIUM CASTING ALLOYS, by A. J. Lyon.

EQUILIBRIUM RELATIONS IN ALUMINUM, MAGNESIUM AND ALUMINUM-MAGNESIUM-SILICIDE ALLOYS OF HIGH PURITY, by F. Keller and E. H. Dix.

PERMANENT MOLD ALUMINUM ALLOY PISTONS.
HIGH STRENGTH GOLD ALLOYS, by E. M. Wise.

Plant Inspection

A.S.S.T.

All inspection trips will start from the Benjamin Franklin Hotel. All members and guests of each of the convening societies are privileged to participate in these inspections.

Tuesday, A.M.

Midvale Co.
Riehle Brothers Testing Machine Co.
Curtis Publishing Co.

Wednesday, A.M.

Leeds and Northrup Co.
Temple University.
Westinghouse Electric and Manufacturing Co.

Thursday, A.M.

Victor Talking Machine Co.
Autocar Co.
Brown Instrument Co.

Friday

Tinius Olsen Testing Machine Co.
U. S. Navy Yard.

Date to be Arranged Personally

William Sellers and Company, Inc.
Bethlehem Steel Co., Inc.
Ajax Electrothermic Corp.
Carpenter Steel Co.

American Welding Society

Tentative arrangements have been made for visiting, on Wednesday afternoon, the General Electric welded building, the plant of the E. G. Budd Manufacturing Co., and an aeroplane plant.

Entertainment

Grand Ball

The ballroom of the Benjamin Franklin Hotel will be the scene of the ball this year, on Tuesday evening.

Dinner for Drop Forgers

The Drop Forge Supply Association will hold their dinner at Bookbinders', Second and Walnut Sts., Wednesday at 6:30.

Institute of Metals Annual Dinner

At the Benjamin Franklin Hotel, in the Ballroom, on Wednesday, the Institute will hold its annual dinner.

A.S.S.T. Banquet

The annual banquet will be held in the Ballroom of the Benjamin Franklin Hotel on Thursday.

A.W.S. Banquet

The A.W.S. will also hold their annual banquet on Thursday, but at the Bellevue-Stratford Hotel. Following the banquet comes the dance.

Ladies' Entertainment

All ladies attending the exposition will have their entertainment as a single group. This includes ladies from the national societies meeting during the week. The registration for the A.S.S.T. ladies will be held Monday at the Benjamin Franklin Hotel. Registration for A.W.S. ladies will be held Monday at the Bellevue-Stratford, and of the I. of M. ladies, Tuesday at the Benjamin Franklin Hotel.

The program is as follows:

Monday

Luncheon, Benjamin Franklin Hotel, Betsy Ross Room, followed by automobile ride. Admission is by ticket only.

Tuesday

Bridge party, Benjamin Franklin Hotel, Betsy Ross Room; or shopping tour.

Grand Ball, Benjamin Franklin Hotel, Ballroom. Admission is by ticket only.

Wednesday

Automobile tour to Valley Forge. Admission by ticket only. Annual dinner of the Institute of Metals at the Benjamin Franklin Hotel.

Thursday

Sight-seeing tour, followed by tea at the Benjamin Franklin Hotel. Admission by ticket only. The tea is at 4:00 p.m. in the Betsy Ross Room.

Annual Banquet of A.S.S.T. at the Benjamin Franklin Hotel.

Annual banquet and dance of A.W.S. at the Bellevue-Stratford Hotel.

IDEAS · FROM · PRACTICAL · MEN

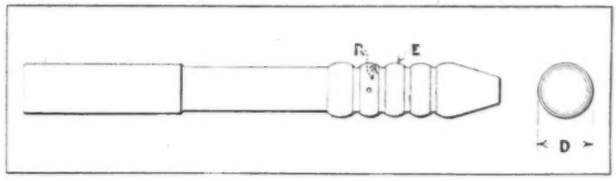
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Burnishing Holes in Aluminum

By Carl E. Schinman

The tool shown in the accompanying illustration was designed for the rapid production of dead smooth holes of accurate dimensions in aluminum-base die castings. Several types of standard reamers were tried for this purpose, but the clogging of chips in the reamer grooves made it impossible to produce holes of the required finish on a production basis.

In operation this tool is held by the shank in a drill press, or any other suitable press. The tool, which is not



A burnishing tool for holes in aluminum

revolved, is pushed through the hole that it is to finish. Provision should be made for holding the work down to permit the withdrawal of the tool. Taper cored holes in die castings should be first drilled with a twist drill.

The burnishing reamers that we use are turned from drill rod, hardened, and the burnishing rings *E* lapped to size. The entering ring should be about 0.004 in. smaller than the finish size, each succeeding ring being 0.001 in. larger in diameter for the $\frac{1}{4}$-in. size, other sizes being in proportion. The radius *R* should equal one-half of the reamer diameter *D*. This burnishing reamer can be used on through holes only. It will produce accurate burnished holes rapidly in aluminum. Its use is particularly indicated for metals that do not machine freely.

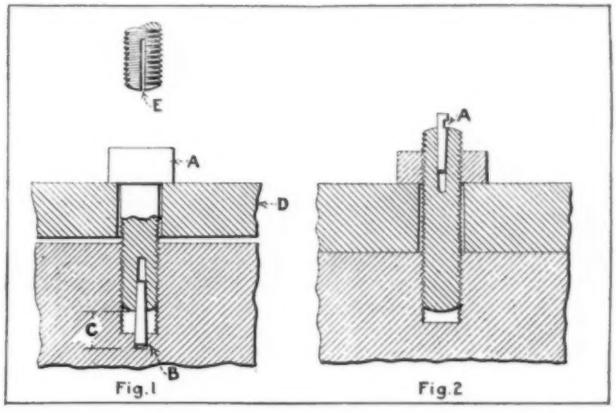
Expansible Threads—*Discussion*

By R. G. Hewitt

Keighley, England

In an article under the above heading on page 1016, Vol. 68, of the *American Machinist*, Henry Simon describes an ingenious method of varying the diameter of threads. In my opinion the method of driving the pin, especially, when a locking action is required, leaves much to be desired. The screw has to be repeatedly tested while driving in the pin until locking action or desired fit is obtained.

To overcome this defect a hole is drilled at *B*, Fig. 1, the size of the large end of the tapered pin, the distance *C* being so arranged that when screw *A*, which is split at *E*, has fulfilled its function in holding the plate in



Locking action by expanding threads

position the downward movement onto the tapered pin locks the screw.

The advantages of this method are that the expansion takes place where most required, the strength of the screw is not materially weakened as the tapered hole is only a third of the length of the screw, and quick adjustment is obtained by use of a spanner.

In Fig. 2 Mr. Simon's method is shown adapted for locking the nut in position. The stud is split about an inch down, the tapered hole being the same length. Removal of the pin is accomplished by means of a lever inserted at *A* under the lip.

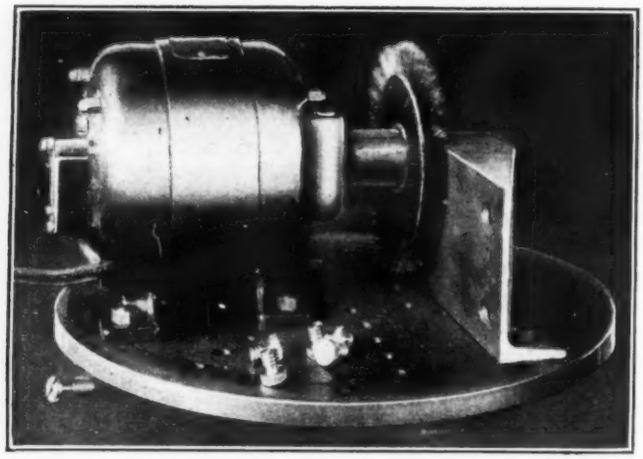
Production Burring of Screw Threads

By Donald Hampson

An end facing operation on some special screws had to be performed after the threads had been cut. Two of the kinds of screws so made are shown in the illustration, one a 12 thread and the other a 24 thread, each on a $\frac{3}{8}$ body. Still another screw of $\frac{7}{16}$ diameter comes under the same treatment, but is not shown.

This end facing operation closes up the last thread a little—not very much, but enough so that assemblers have to "fiddle" with it to get it started in the nut. As a remedy, the conventional method of opening up the thread with a file proved successful, but it took too much time.

A better method was found in the rig here illustrated. A $\frac{1}{8}$-hp. motor was bolted to an odd cast iron disk having faced surfaces and on the motor shaft a wire brush was fastened. A stray piece of steel channel was also bolted to the disk. In the halftone, these two have been shifted for clearer illustration but the brush travels close to the channel and far enough forward to partly cover



Rig for production burring of screw threads

the upper hole in the channel iron seen in the foreground.

With the motor running, the operator sits facing the rig as pictured. The screws are put in the hole from the right, held by the head, and projected through. In that position, they are given a turn backward as if unscrewing from a nut. They are in contact with the brush wires all the time and the latter effectually remove the burr.

The whole operation is done more quickly than it can be told, after a few minutes of practice. The burr is cleaned out of the threads, and there is scarcely anything visible on the end of the screw. Assembling is now done as fast as the parts can be handled.

Piston Methods in a French Shop

By J. A. Lucas

The three operations shown in the accompanying illustrations, give a good general idea of the method employed in machining pistons at the Citroen plant, Paris, France. The first operation of turning the outside is similar to that employed in most American plants. The expanding mandrel by which the piston casting is gripped on the inside and near the head is shown in Fig. 1. The flattened sides of the mandrel permit the passage of the piston-pin bosses, which aid in driving the piston, so that the expanding jaws are used almost entirely for centering the work. At the same time, a drill in the tailstock centers and counterbores the end of the piston for future operations.

Drilling the piston pin hole, or cross boring, is done in the fixture shown in Fig. 2, which is bolted to the faceplate. The block *A* fits into the fixture, and locates the pin in proper alignment for drilling. The swinging latch with its setscrew, locks the block *A* in position during cross drilling. The cross, or pin, holes are finished by broaching as in Fig. 3. Two pistons are placed in each holder, as in the one at the right, and are positioned by blocks as at *A*, in a similar manner as for cross boring. The block also aids in supporting the pistons against distortion from the pull of the broaches. It will be noted that the broaches, in addition to finishing the pin holes to size, also cut small oil grooves in their sides. This view shows the construction of the fixtures in which the pistons are held, and also the way in which the cutting edges and the burnishing portions of the broaches are distributed along their length. This broaching method is quite different from the usual one followed in American shops but has been found to be quite effective.

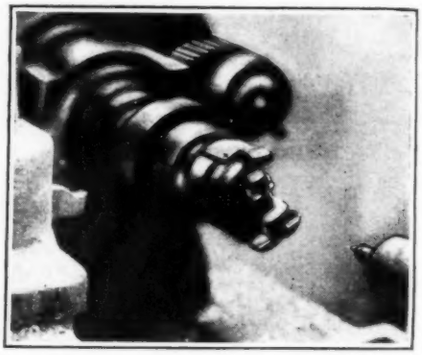
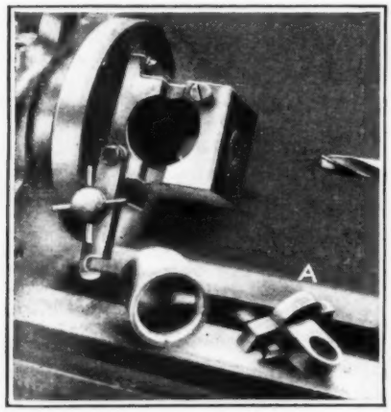


Fig. 1—Expanding mandrel for centering pistons for the first operation



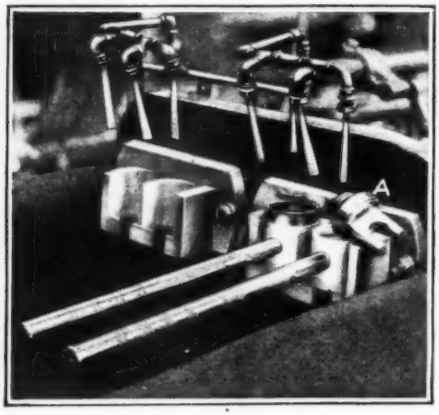


Fig. 2—Method of holding pistons for cross boring, and of locating them in the proper position. Fig. 3—Finishing piston pin holes by broaching. Each fixture holds two pistons for simultaneous broaching on each stroke of the machine

Grinding the Ends of Helical Springs
Discussion

By C. Kugler

In reference to an article on the above subject in the *American Machinist*, Vol. 69, page 289, Mr. Hopsch will have the same difficulty with his stud, because if the springs vary on the outside diameter they will also vary in the hole, and he will have difficulty getting them on and off the stud.

He says that in order to prevent oversize springs from spinning on the stud the latter could be threaded the same pitch as the springs, but he has never found this necessary. Likewise, I have never found springs to vary so much in diameter that they would spin around in the hole and cause trouble in grinding. His device is entirely too slow, and would not be allowed in shops where I have worked, because grinding one at a time would cost too much.

However, if I only have a few springs to grind, which do not warrant the cost of making a fixture, I grind them one at a time by holding them between blocks in an ordinary screw clamp. This method does not cost anything for the fixture, and should the springs vary in size no difficulty will be experienced.

Heat-Resistant Alloys

Heat-resistant alloys are alloys that will withstand continuous heating at high temperatures without serious oxidation. They are employed for carburizing boxes, furnace parts, resistance wires for electrical heating apparatus, automotive engine valves, spark plug points, and for many other articles subject to continuous or intermittent heating. They also generally have high resistance to the corrosive action of acids and alkalies, and some of the alloys are closely related to the group of acid-resistant metals.

The heat-resistant alloys are in general based on nickel and chromium, but may contain amounts of iron up to 60 per cent or more. They may also contain small percentages of manganese, silicon, or other elements to give other properties such as great hardness, increased tensile strength, or additional acid-resistance.

Since chromium and nickel are both expensive metals, the proportion of iron may be increased in the grades which are not expected to withstand the maximum temperatures. The standard alloy for high-temperature resistance wire, for example, contains about 80 per cent of nickel and 20 of chromium. This will withstand continuous heating up to 2,100 deg. F. But for average conditions, where the operating temperatures are only about 1,800 deg. F., iron may be added up to the extent of about 25 per cent and the content of chromium and nickel reduced, with consequent economy of cost. Heat-resistant alloys are marketed under many trade names, and most makers produce their materials in varying grades to meet the service conditions.

Another class of metals sometimes grouped with the heat-resistant alloys is the high-chromium iron and steel belonging to the "rustless" and "stainless" groups. These alloys, when employed for heat-resistance, usually contain more chromium than the ordinary stainless steels. They also contain only a very low percentage of carbon.

Atha's 2,600 Alloy

Atha's 2600 Alloy is the trade name of a heat-resistant and corrosion-resistant alloy containing approximately 22 per cent of nickel, 8 of chromium, 1.75 of silicon, 1 of copper, 0.70 of manganese, 0.50 of carbon, and the remainder iron. It is also resistant to the action of many acids, and is non-magnetic. It is a product of the Crucible Steel Company of America, New York. Atha's 2600 Alloy can be hot rolled into bars and sheets, cold drawn into wire, forged, or cast. It can be machined readily, but not as easily as ordinary steels. It is annealed by quenching in water from a temperature of 1,200 to 1,600 deg. F. The tensile strength, annealed, is from 95,000 to 125,000 lb. per sq.in., and the elongation 25 to 35 per cent. The specific gravity is 7.95, and it weighs 0.29 lb. per cu. inch.

Nichrome

Nichrome is the general trade name of a group of alloys produced by the Driver-Harris Company, Harrison, N. J., and employed for carburizing boxes, resistance wires, and a wide variety of other uses. The standard grade of casting Nichrome for carburizing boxes contains 67 per cent of nickel, 16 of chromium, 12 of iron, and 1 of manganese. It has a tensile strength of 64,000 lb. per sq.in. The melting point is 2,460 deg. F., and it will resist oxidation and scaling at temperatures up to 1,650 deg. F. A grade of Nichrome used for resistance wire contains 60 per cent of nickel, 12 of chromium, 26 of iron, and 2 of manganese. The tensile strength is 100,000 lb. per sq.in. The weight is 0.294 lb. per cu.in. Other grades used for various purposes are marketed. Nichrome IV contains 80 per cent of nickel and 20 of chromium, and will resist oxidation at continuous temperatures up to 2,100 deg. F. The tensile strength is 120,000 lb. per sq.in., melting point 2,535 deg. F., and weight 0.306 lb. per cu. inch.

Ascoloy

Ascoloy is the trade name of a heat-resistant and corrosion-resistant alloy produced by the Alleghany Steel Company, Brackenbridge, Pa. It is a chromium-iron alloy made in the electric furnace, and contains from 12 to 16 per cent of chromium, 0.50 per cent each of manganese, nickel and silicon, and below 0.12 per cent of carbon. It is manufactured in various grades in billets, plates, sheets, bars, tubes, wire and castings, and is employed for tools, mine fittings, screw-machine products, and for various parts requiring a corrosion-resistant and heat-resistant material. The standard grade resists oxidation at temperatures up to 1,500 deg. F. Other grades are produced for temperatures up to 2,200 deg. F. The melting point is 2,723 deg. F. The tensile strength of Ascoloy is 72,000 to 85,000 lb. per sq.inch.

Delhi Rustless Iron

Delhi Rustless Iron is the trade name of a chromium-silicon alloy iron having high rust-resisting and acid-resisting properties. It is also claimed to withstand continuous heating up to 1,600 deg. F. without scaling. It is a product of the Ludlum Steel Company, Watervliet, N. Y. It belongs to the class of stainless irons and steels, but its low carbon content does not permit hardening. It can be forged readily, and is used for machine parts and for articles where oxidation resistance is important. Delhi rustless iron contains, in a typical analysis, about 18 per cent of chromium, 1.5 of silicon, and not more than 0.08 per cent of carbon. Various grades are marketed in all standard shapes. The highest grade gives an ultimate strength up to 110,000 lb. per sq.in. when rolled.

(To be continued on Sheet No. 38d)

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Cutting Loose From Tradition

BY ALL odds the easiest way open to the designer is to take a successful competing product apart and copy its good points, making only the changes necessary to avoid patent protection. That system of "designing," unfortunately, does not lead to much in the way of progress.

A striking example of a design in which traditional features have been utterly disregarded is found in one of the articles in this issue. Without such disregard of conventions, the economies resulting from the substitution of welded structural shapes and steel tubing for iron castings could not have been secured. The new machine bears only the remotest resemblance to others designed for the same purpose and hallowed by tradition. It represents a mental attitude of the designer that is refreshing and highly commendable.

Another departure from accepted practice lies in the building up from standard Ford parts, by welding, of crankshafts and connecting rods. The welded units are not so beautiful as the ones they supplant but they are more satisfactory in service and cost only about a tenth as much, a vastly important factor.

If more designers would adopt this attitude toward traditional features, designs would be far more individual and costs would probably be appreciably lower.

Quality vs. Quantity

METAL working, up to a few years ago, relatively speaking, was concerned primarily with securing the desired form in the product. Quality of the material was not so important. Designers and shop men knew only a few materials and their answer to a mechanical failure was to put more of the same material into the part rather than hunt for a stronger material.

Something of the mental attitude of that day is found in the practice of a famous construction engineer who used steel reinforcing in his concrete structures when that type of building came into vogue, but always put in enough concrete so that it alone could carry the whole load regardless of the steel.

Today we are demanding more in the way of quality of material. Instead of adding several hundred pounds of cast iron to a model to strengthen a weak section we are more inclined to use a stronger material.

If gears fail we don't always make them heavier. More often we use a stronger steel, or else resort to heat treatment of the steel we have been using.

Substitution of materials is current practice. When the foundryman declined to be as progressive in his methods as the circumstances demanded, his customers turned to pressed metal and the various kinds of welding.

To make a practical success of these various innovations it was necessary to learn the basic principles involved—a task for the engineer and the scientist. How far they have gone in their endeavor to meet the requirements is evidenced by the combined meetings to be held in Philadelphia next week. The American Society for Steel Treating and the American Welding Society are both young organizations and the Institute of Metals is not so very old as engineering societies go. Their existence is practically coincident with the new era of quality which they are doing so much to advance, and their growth is indicative of the value of their work.

An Aviation Safety Congress

WHAT better proof that aviation is here to stay commercially can be found than the arranging of a two-day program on aviation safety as a part of the National Safety Congress? So long as aviation was considered to be in the same class with flying trapeze work in a circus, or looping the loop on a motorcycle, there was no reason to give much more thought to the safety of those engaged in it. Many of the early aviators were undoubtedly lured by the danger of the game —the thrill they got from knowing that disaster might overtake them at any moment.

But aviation is growing up. It has proved its value in transporting the mail, by day and by night. And now you can make a reservation for a seat in a plane when you buy your rail ticket for the first part of a composite journey. Or you can start by plane and finish by rail, coming the other way.

Such being the case it is not strange to find safety of operation of airplanes taking its place as equal in importance with safety on other transportation mediums.

Aviation has passed the pioneer stage and its progress will be accelerated from now on.

· SHOP · EQUIPMENT · NEWS ·

Newark No. 3 "Spirit of Production" Hobbing Machine

BOTH universal and plain types of the No. 3 hobbing machine have been added to the line of "Spirit of Production" machines manufactured by the Newark Gear Cutting Machine Company, Newark, N. J. Helical gears, herringbone gears, spur gears and wormwheels can be cut on the universal machine, while spur gears, spline shafts and wormwheels can be handled on the plain type. Capacity of these hobbers is 18 in. with support arm, and 24 in. without this member. Spur gears up to 14-in. face can be handled on either type, while 12-in. helical gears up to 30-deg. helix can be handled only on the universal machine. An improved differential mechanism on the universal hobber permits cutting helical and herringbone gears. This differential allows separate control to the lead, feed and indexing. Any desired feed may be used or altered at any time.

The frame, stanchion, work spindle and its housing, and the feed parts are the same on both types. The horizontal cutting principle is used on these machines, being adapted to hobbing long shafts or gears solid with their shafts. The work spindle is bored 2½ in. for this purpose. Referring to Fig. 1, the power is transmitted by the splined side shaft through a hardened and ground worm mounted in Timken bearings to the combined wormwheel and bevel gear ring. The bevel gear is mounted on the spindle. The ring gear acts as a flywheel, and is completely guarded. The hole through the center is used to convey cutting coolant and chips to the chip box.

The machine has rapid traverse movement to the cutter carriage in both directions either when the hob is revolving or not. Control levers are concentrated on the working side of the machine. Speed change gears are driven by square shafts. Lead, feed and indexing gears are driven by double key shafts, the keys being machined integral or solid with the shafts. The master wormwheel is of high accuracy, being generated in place on its own bearings. The master worm is also mounted on Timken bearings. The over-arm with vertical supports ties both ends of the machine together and gives a rigid support to the work arbor through the sliding arm, which can be removed directly from the end of the over-arm when desired for long special work. Semi-steel and close-grained iron is used on the bearing surfaces.

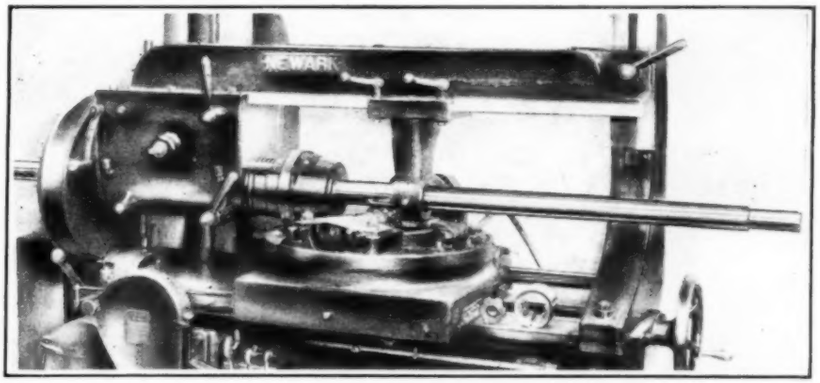


Fig. 2—Long spline-shaft attachment on the Newark No. 3 "Spirit of Production" Hobbing Machine

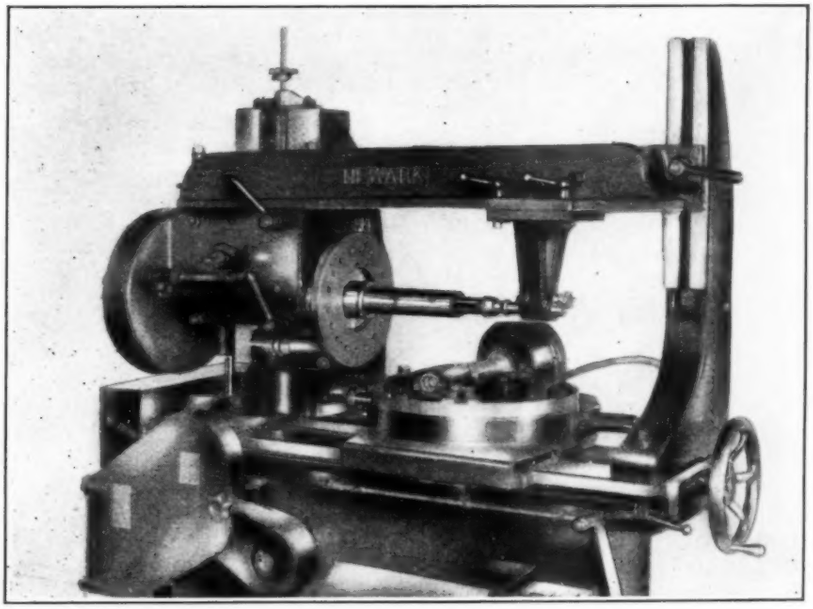


Fig. 1—Newark No. 3 "Spirit of Production" Hobbing Machine

In Fig. 2 is shown the long spline-shaft attachment for automatically hobbing multiple-spline shafts of long length. The regular cutter carriage is clamped to the frame ways when this attachment is in use, and the regular feed mechanism disengaged. The shafts being hobbed are fed through the work spindle automatically. Shafts with any number of splines and of any practical length may be hobbed. Fig. 3 shows a tangential attachment for generating wormwheels with either taper hobs, star cutters or fly tools. According to the manufacturer, the cutting is both rapid and smooth. The attachment is mounted readily by first removing the outer cap-bearing to the cutter spindle. The regular rapid traverse motion and differential mechanism function with this tan-

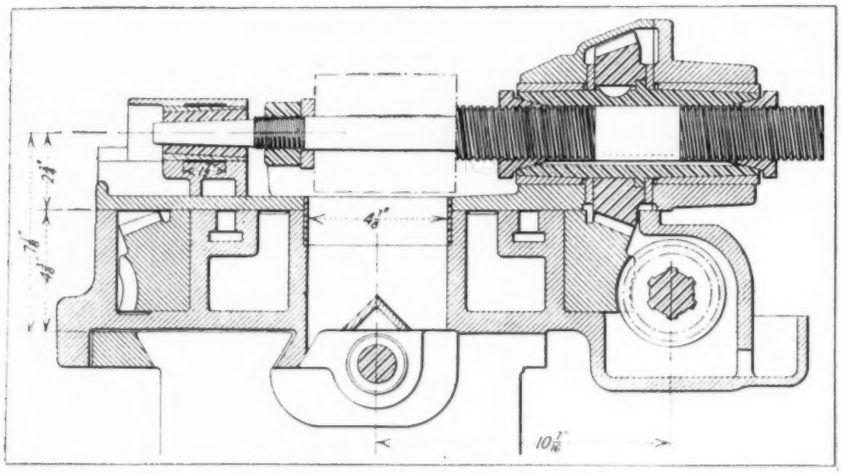


Fig. 4—Cross-section of the cutter drive

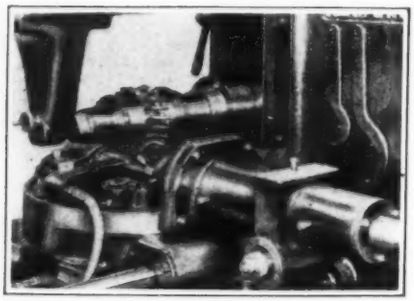


Fig. 3—Tangential attachment for generating wormwheels with taper hobs, star cutters or fly tools

gential attachment. Fig. 4 shows the cross-section of the cutter drive.

Capacity in steel is 4 D.P. and in grey iron 3 D.P. The largest hob that may be used is 4½ in. in diam. by 5 in. long, and is carried on a 1¼-in. hob arbor of the removable type. The work arbor is 1 1/16 in. in diam. Hob speeds range from 38 to 145 r.p.m., and the feeds per revolution of work range from 0.015 to 0.250 in. At full capacity 5 hp. is drawn by the constant-speed motor running at about 1,200 r.p.m. The machine is 7 ft. long x 4 ft. wide and 5 ft. 6 in. high. It weighs 6,000 pounds.

Regular equipment includes one 1¼-in. cutter arbor, one 1 1/16-in. straight work arbor with collars and a pair of stepped flanges, one faceplate with jacks and drivers for large gears, and change gears, including gears for indexing all ratios from 3 to 1 up to 200 to 1, prime numbers above 100 being excepted.

Oxweld Medium-Pressure Acetylene Generators

THREE medium-pressure acetylene generators for welding and cutting have been placed on the market by the Oxweld Acetylene Company, 30 E. 42nd St., New York, N. Y. The type MP-2 is built in two sizes having 50- and 100-lb. carbide capacity, respectively, and replaces the earlier generator of this type. The MP-3 has a capacity for 300 lb. of carbide and is the first of its kind. These three generators are suitable for supplying pressure-type or medium-pressure welding and cutting blowpipes.

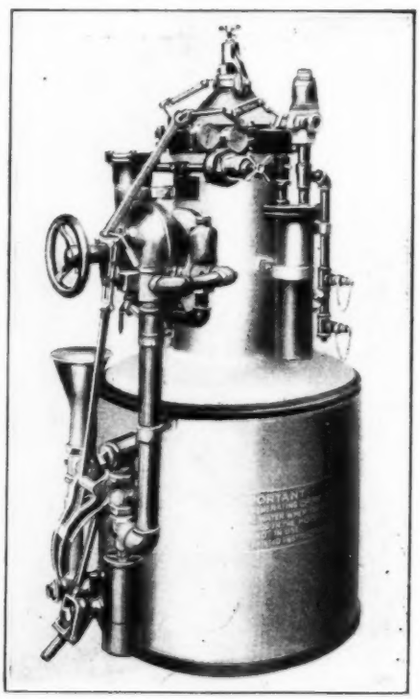
The feed mechanism of the type MP-2 has been re-designed to make the carbide shut-off more positive. The type R.-40 regulator is furnished. This regulator has a large stem and seat, and is equipped with two gages. One of these indicates the pressure in the generator and the other the pressure in the delivery line.

The hydraulic back-pressure valve, which has been simplified, and the filter are of seamless steel tubing. The vertical pipe leading downward to the back-pressure valve and extending below the surface of the water is fitted with an angle check valve. Two relief valves are provided, one mounted on the hydraulic back-pressure valve and the other direct-connected to the generator. Interference levers are provided which unseat the relief valves every time the generator is recharged.

A conveniently placed clean-out door makes the feed mechanism parts accessible. Allowing for the pressure differential, approximately 11 lb. per sq.in. will be the maximum delivery pressure. The type MP-2 generators use ¼x1½-in. carbide. Shipping weight for the 100-lb. size is 1,100 lb. and for the 50-lb. size, 925 lb. The former has a diameter of 3 ft. 5 in. and the latter, 3 ft. 1 inch.

Large capacity is provided in the type MP-3 which has the feed driven by a motor actuated by a weight. A diaphragm pressure-control is used. Two charging doors facilitate filling the hopper. A clean-cut door permits cleaning the carbide feed disk without removing the generator top. The hydraulic back-pressure valve is so arranged that it is always filled with water before the generator itself is filled entirely. A overflow-level check plug is provided.

When recharging is necessary, the interference, which is of simple and sturdy construction, operates the relief valves, locks the feed motor so that it cannot operate, and permits the carbide doors and water filling cock to be opened. The feed motor



Oxweld Medium-Pressure Acetylene Generator

is rendered inoperative if zero pressure exists.

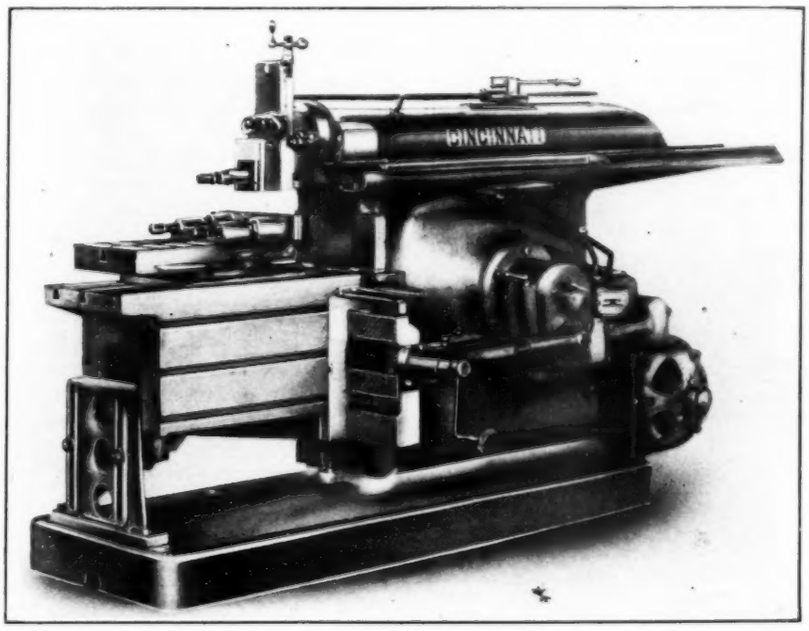
The type MP-3 generator consists of two sections, the lower being a cylindrical shell, the upper a shell in the shape of a truncated cone. The bottom is dished for maximum strength. All seams are bronze welded, both inside and out. This generator uses $1\frac{1}{4}$x$\frac{1}{8}$-in. carbide. The over-all height is slightly over 120 in. and the height to the top of the generator shell is 104 in. The diameter is $42\frac{1}{2}$ in. Weight 2,300 pounds.

Cincinnati 36-Inch Rapid-Traverse Shaper

RAPID traverse is the chief feature of this 36-inch shaper which has been placed on the market by the Cincinnati Shaper Company, Cincinnati, Ohio. All features common to the line manufactured by the above company are incorporated in this shaper. These include, besides the power rapid traverse, automatic oiling, full-length taper gibs with single screw adjustment, selective multiple cam feed, and internal transmission.

The length of stroke is $36\frac{3}{4}$ in., and the strokes range from 8 to 102 per min. The largest tool that can be used is 1x2 in. Eight cutting speeds are provided. The feed to the head is 9 in., while the cross-feeds range from 0.010 to 0.170 in. Horizontal table travel is $30\frac{1}{2}$ in., while the vertical travel is 13 in. Length of the ram is 6 ft. 4 inches.

This shaper has been placed on the market for use as a production tool for short planing, or as a fast tool for emergency jobs. The heavy construction gives accuracy on either type of work. The table top is 16x36 in., and the depth is 20 in. Either belt- or motor-driven types are available. The former uses a 16-in. pulley, running at 550 r.p.m. The motor-driven type requires a 10-hp. motor of the constant-speed type running at 1,800 r.p.m. The belt-driven shaper weighs 7,400 lb., whereas the motor-driven machine weighs 7,900 lb. Floor space required is 12 ft. 1 in. by 5 ft. 2 inches.



Cincinnati 36-Inch Rapid-Traverse Shaper

Blanchard Segment Wheel for No. 16 Motor-Driven Surface Grinder

Cool and fast surface grinding is possible when this segment wheel is used. It is intended for use on the No. 16 surface grinder manufactured by the Blanchard Machine Company, 64 State St., Cambridge, Mass. The segment wheel consists of a chuck with six abrasive segments securely fastened in position by three clamping devices of simple construction and operation. Fig. 1 shows this wheel applied to the No. 16 surface grinder, while Fig. 2 shows two of the segments together with a clamping device.

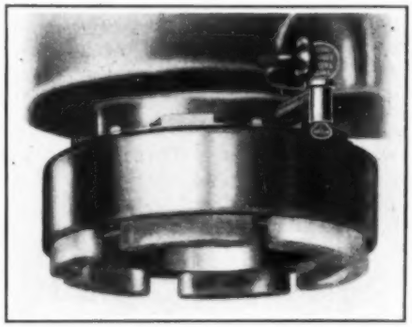


Fig. 1 — Blanchard Segment Wheel applied to the No. 16 Surface Grinder

The chuck body is machined from a solid steel forging, and is rustproofed. It is essentially a channel-shaped ring having three fixed abutments. Between abutments, two segments are placed with a clamping device in the center. The clamping units are made of aluminum bronze except for the screw which is of stainless steel. The abrasive segments are made with rounded ends that match with the radius in the fixed abutments and in the self-aligning shoes of the clamping devices. They are self-aligning, and their outer surface is molded to the same radius as the bore in the chuck body.

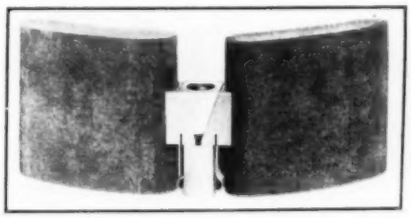


Fig. 2—Abrasive segments, and clamping unit for forcing them securely into the wheel housing

When the clamping screw is tightened, the segments are forced outward against the machined surface of the chuck body and against the fixed abutments. Thus a large friction area takes the clamping pressure. The abrasive segments are six in. in depth when new and over 5 in. can

be used. As they wear down, the segments can be set out so that a 2 in. section protrudes from the chuck. This adjustment is accomplished by running the magnetic chuck under the wheel, unclamping the segments, one pair at a time, dropping them to the face of the magnetic chuck, using a sheet of cardboard or tin to protect its surface, and then reclamping them in place. The three clamping screws are so located as to be comparatively free from dirt. The unit consists of one 18-in. segment wheel, one set of abrasive segments and wrench. The net weight is 127 pounds.

Cincinnati 12-Inch Internal Brake Drum Grinder

BRAKE drums with an internal diameter up to 12 in. can be ground on this machine which has been introduced by Cincinnati Grinders Incorporated, Cincinnati, Ohio. The sequence of operations is as follows: The operator loads the drum on to the head and trips the air valve, which causes the chuck to clamp the drum rigidly. A movement of the second valve causes the drum to move into the grinding position. At the same time rotation is started and coolant flows over wheel and work. A downward movement of the infeed lever causes the grinding to be performed. The drum is brought back to the unloading position and unloaded in two similar operations. Production is quoted at 60 drums per hour, floor-to-floor time, and but one operator to a machine is required.

The main bed casting is of the cored box type, weighing approximately 2,700 lb., with the wheelhead an integral part of the body. The grinding-wheel spindle is a chrome-nickel-steel forging mounted in bronze bearings, and driven by means of a flexible chain from a sprocket in the bed. Automatic lubrication is by means of a pressure-feed system which insures a continuous circulation of filtered oil over the bearings. All of the major operations are accomof the hub, or, as in the case of Ford labor as much as possible. The workhead is pivoted on the infeed slide and moved to and from the grinding position by means of air, controlled by a hand valve conveniently located. By similar means the drums are clamped on the faceplate by a quick-operating air chuck shown in Fig. 2 at the left.

To facilitate smooth operation, the workhead is counterbalanced. All sliding surfaces are lubricated by the Alemite system. A 2-hp. constant-speed d.c. workhead motor is mounted on the swivel head as shown in Fig. 1. It is direct connected through a flexible coupling to a heat-treated steel wormgear. This wormgear drives the bronze wormwheel which rotates the chuck spindle. Location of the drum is taken from the bore of the hub, or, as in the case of Ford drums, from the Timken bearing surfaces. The workhead motor is started and stopped automatically by means of a switch contained in the swivel head. When the head is moved into the grinding position the motor is started, and when swiveled to the unloading position the contact is broken. After the work is brought in contact with the grinding wheel a downward movement of the infeed lever feeds the drum into the wheel. Stock from 0.015 to 0.20 in. is removed so that the piece is brought to the finished size in one operation. To compensate for wheel wear, a hand infeed screw and a micrometer adjustment is built into the infeed unit for accurate setting. The infeed movement is

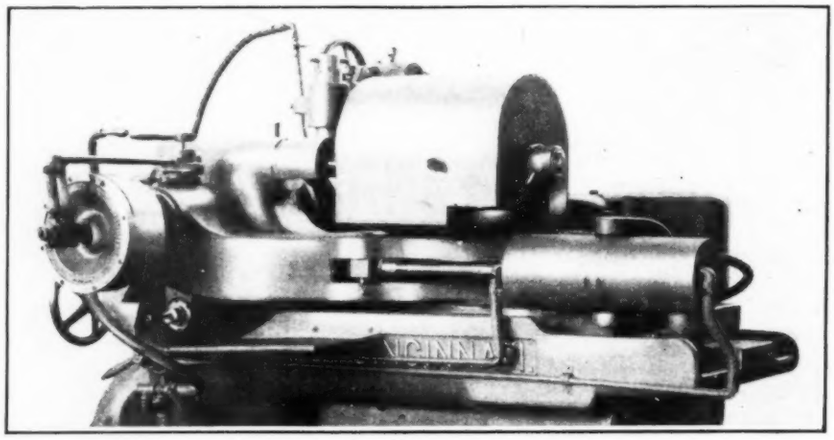


Fig. 2—Side view of the Cincinnati 12-Inch Internal Brake Drum Grinder showing the workhead pivoted on the infeed slide

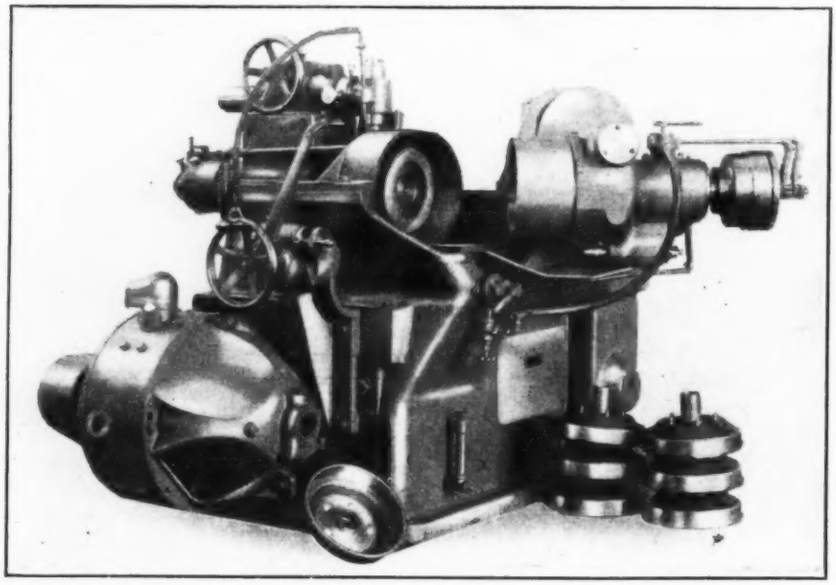


Fig. 1—Front view of the Cincinnati 12-Inch Internal Brake Drum Grinder

accomplished with a minimum of exertion.

The grinding wheel is dressed by means of a rapid-type hand dresser permanently mounted on the head directly over the wheel as shown in Fig. 2. A separate coolant system controlled by a small valve supplies coolant for dressing the wheel, while the coolant supply for the grinding is started and stopped automatically by the movement of the swivel head. The pump is of the impeller type driven from the main drive shaft. It has no exposed bearings. Besides a settling tank in the bed of the machine, a 40-gal. reservoir is supplied.

Power is supplied to the grinding wheel spindle, coolant and oil pumps by a 20-hp. main-drive motor, which is fastened to the bed of the machine on a finished pad. The drive to the main shaft is through an inclosed silent chain.

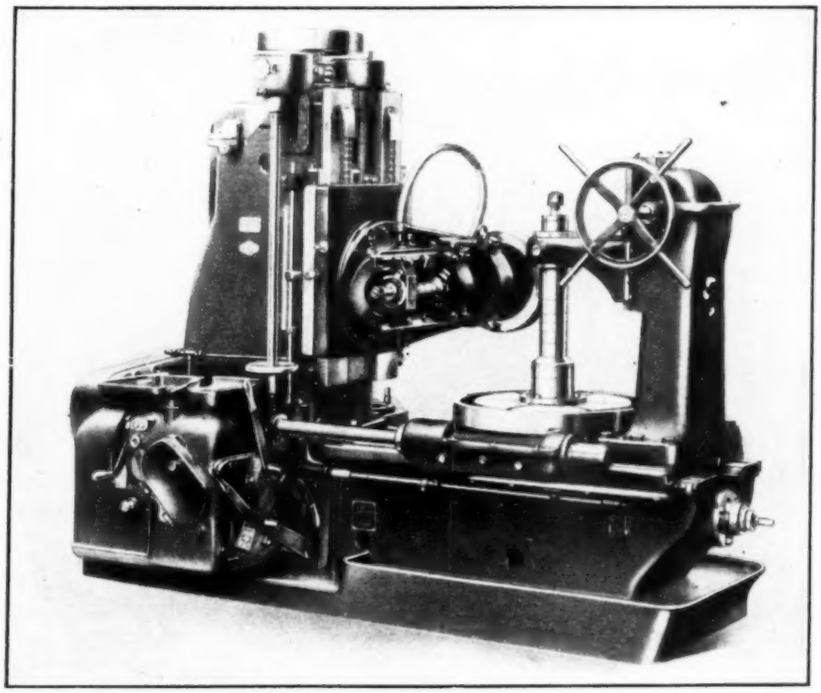
Schuchardt & Schutte No. 10 Improved High-Production Gear Hobber

HIGH production of spur, worm, and spiral gears with involute teeth, as well as special work, can be obtained on this gear hobber, when the differential attachment is used. The machine has been placed on the market in this country by the George Scherr Company, 142 Liberty St., New York, N. Y. It is manufactured by Schuchardt & Schutte, Germany. The maximum size of spur gears that can be hobbed is 40 in., and the maximum face width is 14 in. The maximum D. P. which can be cut is 2¼. As shown, the gear hobber is sturdily constructed.

The bed has been made exceptionally rigid, and is heavily reinforced by ribs. A wide projecting rim around it, which is covered by strainers, serves both as a gutter and receptacle for the coolant. The bed has planed ledges on its bottom and, if suitable cast-iron foundation plates are used, the machine may be leyelled accurately. The column is bolted to the bed of the machine, and is held in position by tapered gibs. It is braced in all directions by strong zigzag ribs. The vertical shaft inside the column turns in two stationary bearings and one traveling bearing, all equipped with ball bearings. To prevent the chips or the coolant from entering the interior of the column, sliding shutter plates are provided below the cutter-head slide. A scale with vernier is provided for the vertical adjustment of the cutter-head slide and for setting the length of feed.

The standard machine is built for single-pulley drive in conjunction with a sliding gearbox furnishing six geometrically progressive speeds. The machine can also be supplied for direct electric drive by a standard d. c. or a. c. motor. The motor should run preferably at about 1,000 rev. per minute.

The cutter-arbor drive is geared to the shaft of the sliding gearbox through shafts and bevel gears. The speed can be varied through wide limits in six steps. The cutter head is fixed to the cutter slide which moves on the vertical column, and can be swivelled in both directions through 360 deg. A graduated dial, reading to 90 deg. either way, and a vernier are provided for setting the cutter head accurately to 1 min. of angle. The cutter slide is balanced by a counterweight. The cutterhead slide moves on wide flat ways, and is securely guided on the narrow ways. A flywheel is placed on the cutter spindle, and by its momentum insures uniform cutting of the hob. Another flywheel is fitted on the vertical driving shaft on the inside of the upright.



Schuchardt & Schutte No. 10 High-Production Gear Hobber

Hob Overhang Reduced

Semi-circular construction of the cutter head envelops half the diameter of the hob and reduces overhang. Drive to the hob is by helical gears. The main cutter spindle bearing is adjustable to a scale and vernier by means of a rack and pinion. This bearing, as well as the outer bearing of the cutter arbor, is equipped with adjustable taper bushings made of bronze alloy. Power rapid traverse is provided both for the cutter head as well as the table; also hand adjustment for the cutter head by means of handwheel on top of feed gearbox, and for table by means of crank at face of bed. Quick return of the cutter head is independent of the feed mechanism, therefore when cutting helical gears in two cuts, the rapid return is used without losing the lead of the spiral.

Circular movement of the table is derived from a wormwheel and a

hardened and ground worm. The wormwheel is made of cast iron, while the worm is of steel. Both wormwheel and worm run in an inclosed oil bath. The worm may be adjusted radially to the wheel by means of a specially arranged set of gears. The work table is of sturdy design and turns in V-ways. It is supported by a flat way close to its outside rim, and is guided by a long and rigid cylindrical trunnion. The coolant drains in the table permit the chips being carried away freely by the coolant. The table feed screw is located close to one narrow guide way. By this arrangement shafts integral with gears can be inserted and chucked in the large table bore without interfering with the feed screw. Micrometer dials are provided to facilitate accurate adjustment. The working surface of the table is provided with radial T-slots. The table carriage may be locked securely in any position. For setting the table accurately to any specified center distance when hobbing wormwheels, a scale is sunk into the ways of the bed on the operator's side.

FEEDS CONVENIENTLY LOCATED

The differential and feed gearbox is located at the operating side of the machine. The differential accelerates or retards the rotation of the table for cutting spiral gears, and is also required for the production of wormwheels by means of the tangential-feed head. The differential gears are housed in a dustproof case filled with a lubricant. Conveniently located levers serve for throwing in the vertical and horizontal feeds, and for operating all movements of the work table and table carriage as well as the cutter-head slide. The levers actuating the feed and quick-power travel are interlocked.

The differential and feed gearbox in front of the column provides nine different changes of feed which can be made at any stage of operation. Provision is made for increasing the number of feeds by interchanging two pick-off gears. Since in hobbing right- and left-hand spiral gears the direction of rotation of the drive of the machine has to be changed, a combined reversing gearing is arranged within the feed box which imparts to the cutter-head slide always the same direction of feed. At the rear end of the differential gearbox, the dividing change gear quadrant is located, on which those dividing change gears are mounted that are necessary for the particular number of teeth of the gear to be cut. On the front side of this gearbox the quadrant for mounting the differential change gears is arranged. Both quadrants are protected by hinged cast-iron boxes.

With the standard dividing change gears all numbers of teeth from 5 to 100 can be cut. In case the machine is equipped with the differential attachment, it is possible to cut all prime numbers of teeth with the aid of the differential gear without the need of special prime number change gears.

Automatic lubrication to the driving elements is provided from a reservoir supplied continually by a special pump. The coolant always spurts on the hob direct from the large spout, independent of the position of the cutter head.

Société Genevoise Quick-Reading Gear Tester

RAPID inspection of gears may be performed on this gear tester which has been placed on the market in this country by the R. Y. Ferner Company, Investment Building, Washington, D. C. The machine is manufactured by the Société Genevoise d'Instruments de Physique, Genève, Switzerland. Its range includes the testing of pitch and eccentricity of bevel, helical and spur gears with straight, oblique or spiral teeth, and the profiles of the teeth of helical and spur gears.

The tests of eccentricity and pitch are made simultaneously. For these tests two dial indicators with contact points and lever systems are mounted on a column. This column is secured in the T-slot of a carriage which fits across the ways of the bed of the machine. The lever system, connecting one contact point with the upper indicator is arranged so that the contact point can move in a radial direction only, and so shows the eccentricity on its dial. The other contact point can move tangentially only with reference to the gear wheel being tested, and so registers on the lower indicator the variations in pitch. This contact point may be set to drop into the space next to that performing the eccentricity measurements, or the two may be separated by the space of several teeth.

The contact point for recording eccentricity serves also as an indexing point when the gear is rotated. The dials of the two indicators are arranged to read zero at their first setting, so that the following readings of pitch are the variations of the successive spaces from this first space. The accumulated error of pitch from this initial point may be obtained readily by taking the algebraic summation of the readings to each point

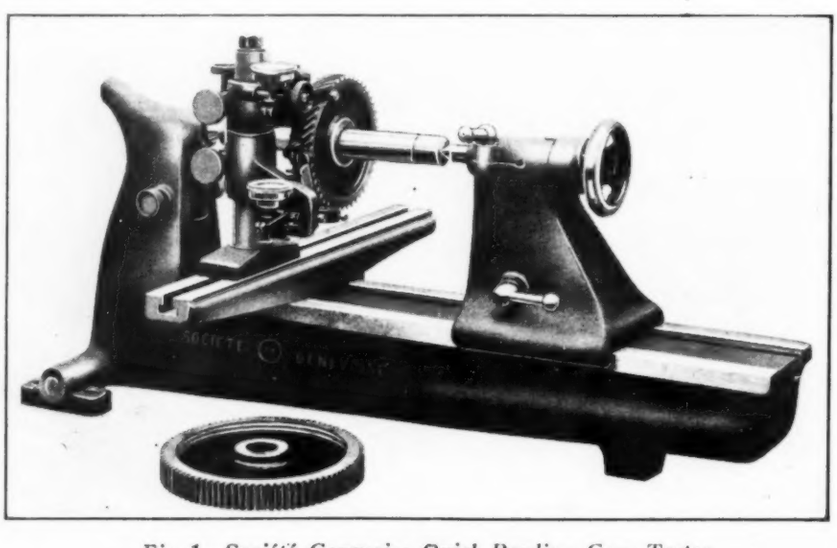


Fig. 1—Société Genevoise Quick-Reading Gear Tester

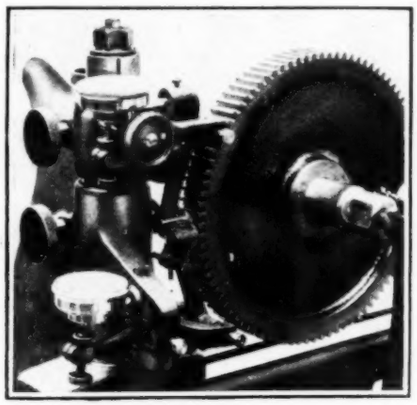


Fig. 2 — Close-up of lever system and indicators on the Société Genevoise Quick-Reading Gear Tester

after distributing uniformly any closing error there may be about the complete circle.

The contact points are made of thin hardened steel plates, and are mounted in parallel planes close to each other, but so that they do not interfere when measuring fine pitches. The levers, in which they are mounted, are made to engage in such a way that when a knurled head near the upper dial is rotated, both contacts are removed simultaneously from between the teeth. When the gear is rotated the space of one tooth, they again drop into the spaces between the teeth, thus engaging the flanks of the teeth at once, and showing the new readings on the dials immediately. The readings can be taken as fast as the contact points can be raised, the gear turned the required amount, and the points lowered.

Usually six sets of contact points are furnished with the apparatus, which take care of the range of 25 to 3.5 D. P., but contact points for other pitches down to 2 can be supplied, if desired. The apparatus will test gears up to $11\frac{3}{4}$ in. diam., and has a minimum distance between centers of $15\frac{3}{4}$ inches.

For checking of the profile of gear teeth, the bed of the machine may be turned up on end, and a checking device attached to the ways of the bed in the horizontal position. This checking device will test either flank of a gear tooth as to whether it has the proper involute form, and can be set to check for various pressure angles. Details of the construction of this device were given on page 635, Vol. 61, of the *American Machinist*.

Producto-Matic No. 50 Double-Spindle Opposed-Feed Milling Machine

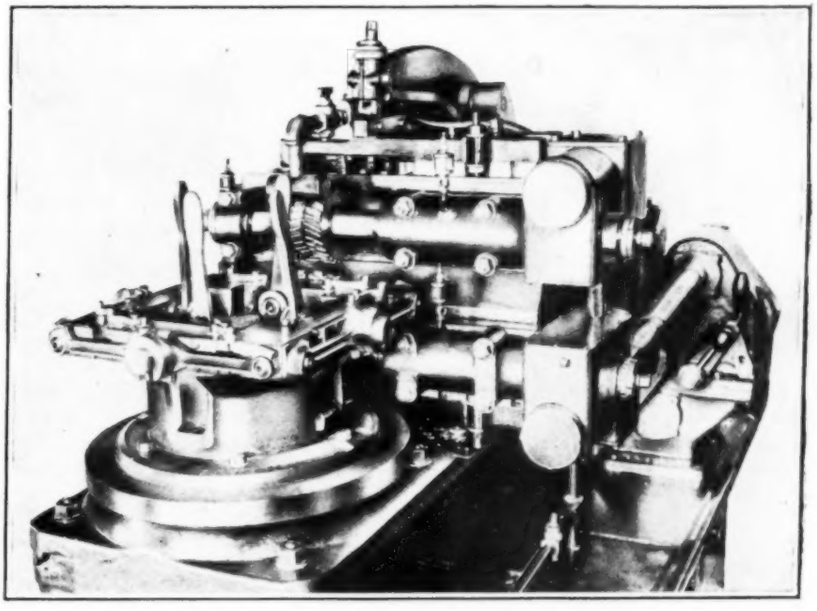
THE Producto Machine Company, Bridgeport, Conn., is placing on the market the No. 50 Producto-Matic illustrated, having two cutter spindles with opposed "scissors type" feed. The machine was designed for the side milling of automobile connecting rods, and slitting the cap from the rod. By changing the fixtures, however, it can be used for any job that is to be milled on both sides at one time, such as the grooving of two sides of bushings, studs and similar parts.

The cabinet base, bed, and indexing table are the same as on the standard Producto-Matic machine. Two entirely independently acting cutter spindles and blocks have been provided, the top spindle feeding downward and the lower one having an upward feed. The top spindle is operated by a feed lever, which is driven from a heavy cam on the main camshaft at the rear of the machine. Adjustable rollers are provided at both ends of the feed lever, and the spindle slide is held up against the front roller by three heavy springs, in order to insure smooth action. The lower spindle slide is operated by a duplicate feed lever from the bottom, the two levers giving a scissors-like motion. The cams operating the levers can be changed to give different lengths of stroke for different jobs.

The ram carrying the two spindle blocks feeds outwards, and is operated by a large internal cam at the left side of the machine. This cam is on the main camshaft. The camshaft is driven through a worm and wormgear, the worm being driven by a silent chain from the motor in the bottom of the machine connected to a gear case, which is arranged for giving different feeds by simple gear changes.

Each spindle is driven through a wormgear and worm, the worm being driven by a bevel gear from a vertical shaft. The drive boxes are connected to the standard gearbox in the rear of the machine by a universal-jointed shaft. This gear box is also driven by a silent chain from a change-gear case in the bottom of the machine. Various spindle speeds can be obtained by changes of the gears. The spindles are reversed by a lever movement at the gearbox on the side of the machine.

The work table is the same as on the standard machine. The fixture is special, and the set-up illustrated below is for side milling the bolt lugs



No. 50 Producto-Matic with double spindles and opposed feed

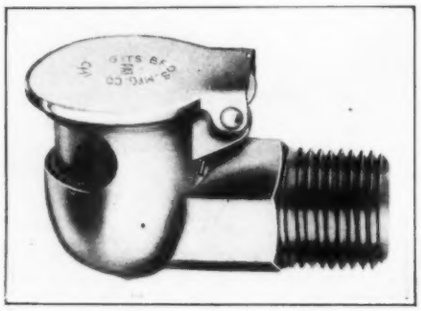
of a connecting rod and taking a cut across the top without indexing. Four cuts are taken at one time on two connecting rods, and the production is 625 connecting rods per hour.

Roller and ball bearings are used throughout the machine at all important points. The spindles are hardened and ground, and run in bronze bearings. The wormgears driving the spindles are of special bronze, and the worms are of hardened steel. The spindles can be adjusted vertically, and there is provided a final micrometer adjustment on the end of the feed lever. The spindles can also be adjusted horizontally for setting the cutters centrally.

Lubrication of the transmission is by automatic forced feed. The spindle bearings and slides have sight-feed oilers. Cutting compound is supplied from a 40-gal. tank in the front of the machine base by means of a pump having a capacity of 10 gal. per min. The machine is driven by a 7½- or 10-hp. motor located in the cabinet base.

Gits Style S G B Angle Oil Gage

Both the functions of filler plug and oil-level gage are performed by this Style S G B 90-deg. oil gage with sight glass which has been placed on the market by the Gits Brothers Manufacturing Company, 1940 South Kilbourn Ave., Chicago, Ill. It is applied principally to electric motors. Two sizes are available. The smaller has an overall height of 1¼ in., a body 1 in. in diam., and a ⅜-in. pipe shank. The larger has an overall height of 1⅝ in., a body diam. of 1¼ in., and a ½-in. pipe shank. The body is of one-piece brass construction, and has an opening to accommodate a glass gage by which the oil level is determined. It is therefore used extensively for oil reservoirs, ball bearings, and housings on motors. A self-closing hinge lid is provided. The standard finish is mechanical nickel plate.



Gits Style S G B Angle Oil Gage with Sight Glass

Hevi-Duty Wild-Barfield Electro-Magnetic Hardening Furnaces

ALL steels having above 0.4 per cent carbon content can be hardened in the Wild-Barfield electro-magnetic furnace to obtain fine grain structure. This furnace, which was developed in England, is manufactured under license for the United States, Canada and Mexico, by the Hevi-Duty Electric Company, Milwaukee, Wis. The furnace works on the principle that at the point where steel loses its magnetism upon heating it should be quenched, as at this temperature complete diffusion of the cementite occurs. High-speed, high-temperature steels do not respond to this treatment. In Figs. 1 and 2 are shown two sizes of this furnace. Both horizontal and vertical types are available in a large variety of sizes. The general arrangement of the heating and magnetizing windings are the same in both types.

Critical temperatures of steels depend upon the rate of heating, the furnace temperature, the size of the sample, the composition, and the length of time in the furnace. It can be shown that two samples of the same stock and of equivalent size when heated in furnaces at different temperatures should be quenched at temperatures which vary by as much as 55 deg. F. because both samples should be quenched when the magnetism is zero. In Fig. 3 are shown the heating curve and the loss-of-magnetism curve for carbon tool steel. As illustrated, the period of decalescence would be the region for quenching by pyrometric measurement. However, since steel does not reach the point of complete cementite diffusion until zero magnetism is reached, the correct temperature is 36 deg. above the indicated temperature.

The method of working the furnace is simple. An electrically heated fur-

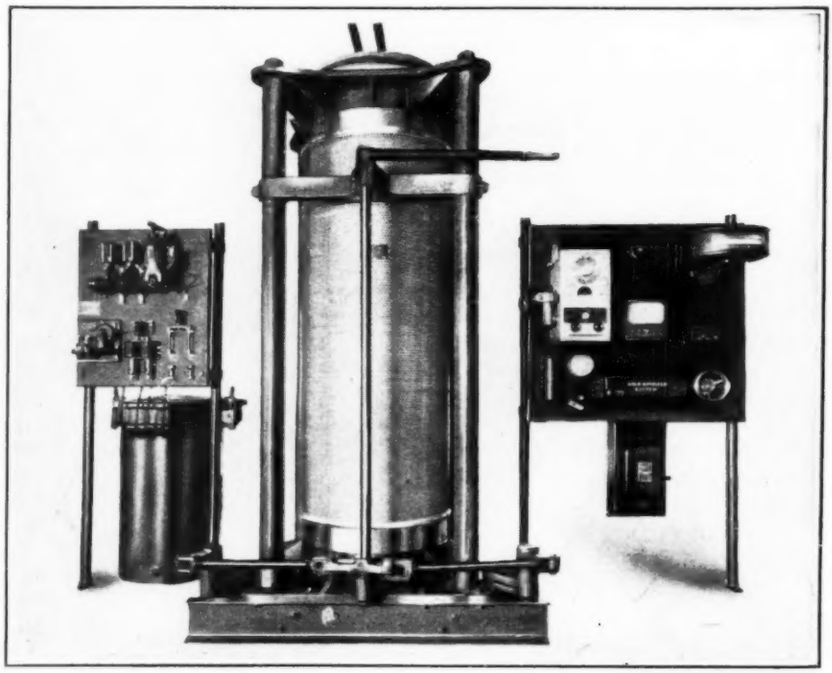


Fig. 1 — Special Hevi-Duty Wild-Barfield Industrial Furnace magnetically equipped for the hardening of tubes. The tubes are discharged through a mechanically opened bottom into the quench below

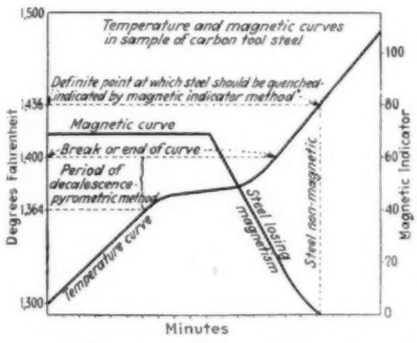


Fig. 3—Curve showing that the correct quenching temperature does not lie in the period of decalescence

nace of either horizontal or vertical type heats and at the same time magnetizes the work. The primary winding furnishes the heat. The secondary winding is electrically connected to a magnetic indicator on the switchboard. At the moment at which the indicator needle moves to zero, the operator quenches the work. The indication is provided automatically irrespective of time, temperature conditions, the rate of heating, or the shape and nature of the charge. The furnace is insulated, and is surrounded with a case of polished aluminum with cast ends. The furnace temperature is controlled by a rheostat, and a warning lamp on the switchboard indicates excessive temperatures, such as above 1,760 deg. F. At this point a fuse melts and the current is thrown off of the furnace.

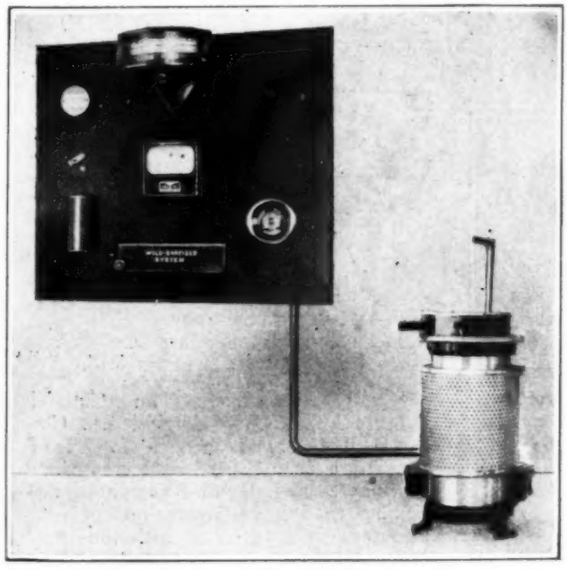
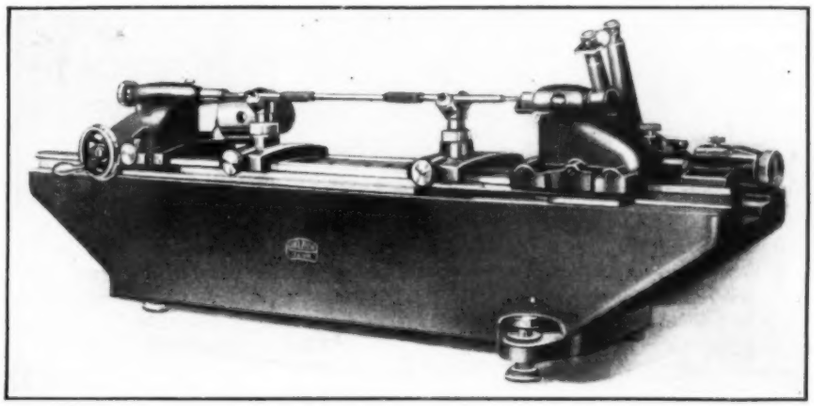


Fig. 2—Small size Hevi-Duty Wild-Barfield Magnetic Hardening Furnace

Zeiss 40-Inch Measuring Machine

BOTH external and internal measurements, either absolute or comparative, may be obtained by the use of this machine, which is being placed on the market in this country by the George Scherr Company, 142 Liberty St., New York, N. Y. It is built by Carl Zeiss, Jena, Germany. The measuring elements are a graduated glass rule and an optical indicator. The graduation is brought into plain view through the aid of a microscope, the deviation from the nominal value being determined by the optimeter. Microscope and optimeter tubes are placed alongside of each other, so that even on a 20-ft. machine the operator need not change his position. The headstock, by the action af a handwheel and screw is passed over the glass rule, until the zero line of the rule appears in the eyepiece of the microscope. Then the tailstock is shifted over the respective mark until the latter also appears in the ocular of the microscope. This is due to the application of a compound lens and prism system lighted by a common lamp. Thereupon the headstock is adjusted by the micrometer screw until the double zero line on the glass mark in the bed incloses the zero line of the glass rule. The anvil spindle is next shifted until the optical indicator is at zero. The machine may now be set to any of the marks spaced



Zeiss 40-Inch Measuring Machine

graduation of the glass rule consists of 800 intervals, each 0.005 in. apart. The fractions of each interval are determined by the optimeter. The scale of the latter has a range of plus or minus 0.005 in. subdivided into 1/20,000 in., and 1/100,000 in. can be estimated readily. The measuring pressure is kept uniform by this optical indicator at about 7 oz., independent of the skill of the operator. The anvils are made of agate, and are adjustable for parallelism. The operation is as follows: The 4 in. apart, and both the adjustment of the anvil and the graduation be viewed through the microscope. After the approximate size has been determined and the machine set accordingly, the readings may be taken.

The graduation of the glass rule is produced by the aid of light-wave interference. The accuracy thus obtained is so high that over the range of 4 in. the error will nowhere exceed 1/20,000 of an inch, according to the manufacturer. The setting from one 4-in. mark to the next is made by an optical system which travels with the headstock and is viewed through the microscope used for reading the graduation.

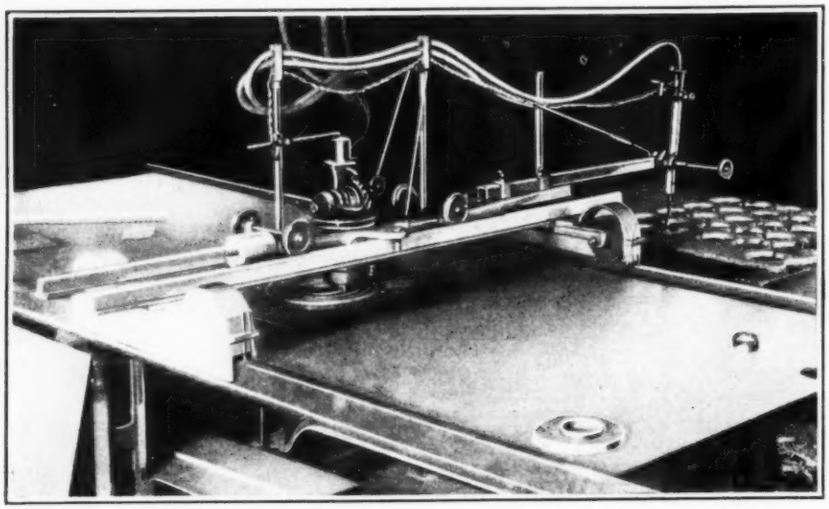
The bed of the machine is heavily ribbed and carries both headstock and tailstock, as well as roller supports for holding end rods and a table for blocks, snap and plug gages. The

headstock runs on balls, likewise the table, which is of the floating type. The headstock carries the microscope and optimeter, while the glass rule is concealed within the bed to protect it from injury.

Oxweld Shape-Cutting Machine

An automatic oxy-acetylene shape-cutting machine designed to cut shapes of any sort from steel plate, forgings, billets or ingots has been placed on the market by the Linde Air Products Company, 30 East 42nd St., New York, N. Y. In this machine the cutting blowpipe is mounted on a carriage which is moved in any direction by means of an electric motor. For routine production, it will operate automatically from templets. In cases where only a few parts are to be cut out, a hand tracing device can be attached and used to follow the outline of a sketch or blueprint.

The parts of the machine are built sturdily, but do not impair the delicacy of adjustment. The rigid construction makes for accurate cutting. One operator is required. Little machining is necessary in most cases after cutting, because the parts are produced with straight corners and smooth faces. The speed of cutting ranges from 3 to 20 in. per min., depending upon the thickness of the metal. Accurate and smooth cuts can be made in stock up to 1 ft. and more in thickness, according to the maker.

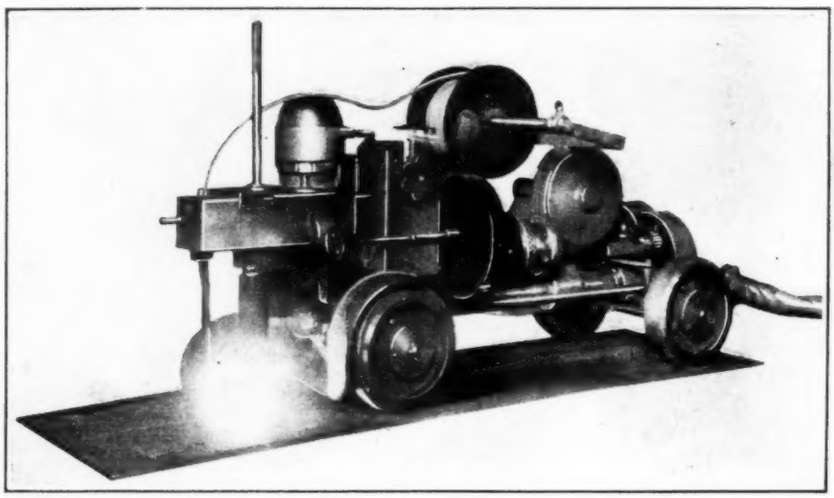


Oxweld Shape-Cutting Machine

Lincoln Tractor-Type "Electronic Tornado" Welder

AN AUTOMATIC tractor-type arc welder utilizing the "Electronic Tornado" principle, and used for making lap and butt welds on large tank bottoms, roofs, and large pipe has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio. The machine, as shown in the illustration, consists of an Electronic Tornado head mounted on a self-propelled four-wheel-drive carriage. Power is supplied through a flexible cable. All that is necessary to operate the machine is to line it up over the seam to be welded and start the arc. The electrode and fibrous autogenizer are fed automatically as the tractor travels forward.

In making lap welds with this machine, no filler metal is used. The heat of the carbon arc fuses the edge of the top plate into the lower plate, making a leakproof joint. A filler strip is laid over the seam to be welded when a butt weld is desired.



Lincoln Tractor-Type "Electronic Tornado" Welder

The chief advantages of this machine, according to the manufacturer, are the high welding speeds and smooth uniform welds. Speeds on $\frac{1}{4}$-in. lap joints varying from 50 to 75 ft. per hour have been obtained.

Trade Catalogs

METAL BALLS. The Hartford Steel Ball Co., Hartford, Conn., has published a price list for 1928 on metal balls suitable for bearings and other purposes. These balls are made of carbon steel, high-carbon chrome-alloy steel, bronze, Monel metal, and stainless steel. Sizes up to $\frac{5}{8}$ in. in diam. are standard.

SPEED REDUCERS. The Cullman Wheel Co., 1344-54 Altgeld St., Chicago, Ill., has published catalog No. 3 showing a line of speed reducers of both the single- and double-types in capacities up to 5 hp. Dimensions of each size are given together with the speed ratios obtainable. Photographs of both the reducers and installations are given. Each part is also illustrated. The catalog contains 32 9x6-in. pages.

NEWS OF THE WEEK

Machine Shop Practice Meeting Is Unqualified Success

Greater part of meeting held on night boat "Cincinnati"

MORE than two hundred satisfied engineers departed from Cincinnati on Thursday, the 27th, or resumed their duties in that city, at the conclusion of the four-day second national meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers. Upon the part of every delegate there was evident the greatest enthusiasm for the type of meeting and the papers. There were countless expressions of appreciation for the work of the Cincinnati Section and the Division.

All of the social features and the greater part of the technical program of this meeting were staged on the night boat "Cincinnati" en route to and returning from Ashland, Ky., where the engineers were guests of the American Rolling Mill Co., and were shown through the plant devoted entirely to the continuous rolling of steel sheets, and having a capacity of 2 tons of finished sheets per minute.

Deck sports and other forms of entertainment enabled the engineers to become acquainted with their fellows to an extent that would have been impossible under most other conditions, with the result that there was a spirit of fellowship seldom so evident at such meetings. The meeting and the friends will not be soon forgotten; the engineering inspiration gained from the Armco plant and the plants of the machinery industries of Cincinnati will undoubtedly appear in practical form in the work of the engineers attending.

Armco Plant Visited

A remarkable method of handling the largest group that has visited the Ashland plant was demonstrated by the Armco organization. Fifty automobiles met the engineers at the boat. The driver of each car was also its owner; he was, in addition, a responsible Armco man and conducted his group of four visitors through the plant. Arrows to indicate the most desirable route were conspicuous throughout the plant.

In the Cincinnati plants somewhat the same system was followed, no group being large, and top men being provided to explain details.

At the conclusion of the inspection of the sheet plant, the Armco organization provided luncheon, at which informal addresses were made by J. C. Miller, vice-president of the company, in charge of the Ashland plant; Bennett Chappelle, vice-president of the company; E. A. Muller, president of the King Machine Tool Co., Cincinnati, and vice-president of the A.S.M.E.; Ralph E. Flanders, manager of the Jones and Lamson Machine Co., Springfield, Vt., and member of council, A.S.M.E.; and L. C. Morrow, Managing Editor, *American Machinist*, and chairman of the executive committee of the Machine Shop Practice Division.

Papers Presented

The list of papers presented and the names of the speakers follow: Symposium on Aeronautic Machine Shop Problems led by H. W. Roughley, quality manager, Wright Aeronautical Corporation, Paterson, N. J.; "Theories of Bearing Lubrication," by Forrest E. Cardullo, chief engineer, G. A. Gray Co., Cincinnati, Ohio; "Grooving Bearings for Machine Tools," by G. B. Karelitz, research department, Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.; Symposium on Machine Tools, Their Use and Application in Modern Manufacturing Methods: "Automotive Industry," by L. L. Roberts, mechanical superintendent, Packard Motor Car Co., Detroit, Mich.; "Electric Industry," by J. R. Weaver, superintendent of manufacturing equipment, Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.; "Agricultural Implement Industry," by Max Sklovsky, chief engineer, Deere & Co., Moline, Ill.; "Railroad Industry," by L. A. North, shop superintendent, Illinois Central Railroad System, Chicago, Ill. Abstracts of most of these papers will be published in the *American Machinist* in an early issue.

Presiding officers at the technical sessions were: Ralph E. Flanders, manager of the Jones and Lamson Machine Co., Springfield, Vt.; L. C. Morrow, managing editor, *American Machinist*, and chairman of the Machine Shop Practice Division; Walter W. Tangeman, sales manager, The Cincinnati Milling Machine Co., Cincinnati, Ohio, and a member of the Executive Committee of the Machine Shop Practice Division.

Discussion made valuable contributions at the sessions. The paper by Mr. Cardullo, in particular, uncovered some differences in opinion. Among those who contributed to the discussion of the paper were H. A. S. Howarth, Kingsbury Machine Works; Dr. Herschel, Bureau of Standards; M. Hersey, Bureau of Standards, and Chairman of the Lubrication Research Committee of the A.S.M.E.; Prof. E. O. Waters, Yale University, and G. B. Karelitz, of the Westinghouse company.

Among important announcements made during the course of the meetings was one by the chairman of the Division that the members of the executive committee hope to hold the third national meeting of the Division at Cleveland during the week of the National Machine Tool Builders exposition, in September, 1929.

Cincinnati machinery manufacturers received acknowledgements of appreciation from delegates and members of the Cincinnati section. Practically all of the plants of the concerns contributing to the local A.S.M.E. fund, and named in the following list, were open to the visitors:—

The Acme Machine Tool Co.; Ahrens-Fox Fire Engine Co.; Allis-Chalmers Manufacturing Co.; The Alvey-Ferguson Co.; American Laundry Machinery Co.; American Tool Works Co.; Avey Drilling Machine Co.; Boye & Emmes Machine Tool Co.; The Century Machine Co.; The Cincinnati Ball-Crank Co.; The Cincinnati Bickford Tool Co.; Cincinnati Engineering Tool Co.; The Cincinnati Gear Co.; Cincinnati Grinders Incorporated; The Cincinnati Milling Machine Co.; The Cincinnati Planer Co.; The Cincinnati Shaper Co.; The Crosley Radio Corporation; G. A. Gray Co.; The Hisey-Wolf Machine Co.; The Joseph Honhorst Co.; King Machine Tool Co.; R. K. LeBlond Machine Tool Co.; Lodge & Shipley Machine Tool Co.; Lunkenheimer Co.; The John B. Morris Foundry Co.; National Marking Machine Co.; The Stuebing Cowan Co.; Tool Steel Gear & Pinion Co; The U. S. Electrical Tool Co.; Worthington Pump & Machinery Corporation.

Important Paper on Gear Tooth Quality at A.G.M.A. Meeting

"Predetermining Gear Tooth Quality" is the subject of one of the papers to be presented at the semi-annual meeting of the American Gear Manufacturers Association, to be held in Buffalo at the Statler Hotel, Oct. 11-13. It is to be delivered by Russell M. Coldwell of the Fellows Gear Shaper Co., and particular attention is called to this paper because it was originally intended to be included in the program of the tenth annual meet-

ing of the association, held in 1926, but was delayed because the time was not then considered ripe for its presentation. Since that time a large number of requests have come in for the paper, so that it is expected that considerable interest will be aroused.

Other technical papers to be presented are: "The Effect of Arc Welding on Manufacturing," by J. F. Lincoln, vice-president, The Lincoln Electric Co.; and "Nitration of Steel," by W. H. Phillips, Molybdenum Corporation of America. S. B. Botsford, manager of the Board of Commerce of Buffalo, will deliver an address on "The Niagara Frontier" on Thursday evening.

At a joint session with the Machine Shop Practice Division of the American Society of Mechanical Engineers, on the evening of Oct. 12, two papers will be presented: "High-Speed Gearing — Some Requirements and How They Are Attained Commercially," by Ira Short, marine engineer, Westinghouse Electric & Manufacturing Co.; and "The Pratt & Whitney Gear Shaving Process," by H. D. Tanner, Pratt & Whitney Company.

Reports of committees to be heard include: Metric Committee, Research Committee on Gears, and Committees on Spur Gears, Keyways, Metallurgy, Herringbone Gears, Bevel and Spiral Gears, Worm Gears, Gears and Pinions, Non-Metallic Gears, Tooth Form, Nomenclature, General Standardization, and Inspection.

One of the social events of the A. G. M. A. meeting will be a luncheon given by A. A. Floetzner, of the Covert Gear & Manufacturing Co. An invitation has been extended to all members and guests attending the meetings.

French Metal-Working Industry Awaits Better Credit Facilities

By Our Paris Correspondent

FRENCH metal-working industries, which include all manner of metal manufacturers, have been for long complaining of restricted credits, thus preventing them in one instance from installing new equipment and in the second instance the carrying stocks during the dull hold-over seasons. What is probably needed is a rationalized credit system. In the automobile industry, in one specified case, that of the Citroen Company, a credit selling company, with American capital participating, has been formed.

This is but a single phase. What is of more concern to the American manufacturer of productive machinery who would sell in the French market is the possibility of extending credit to the French purchaser of his product, assuming that it is not consumer goods that is in question. There is not a dealer or distributor of machine tools in France but knows that if he could, by banking or other arrangements, extend a longer credit he could largely increase equipment sales and thus displace other non-efficient, low-output machinery already in operation. The manufacturer himself, working with inadequate equipment, knows this also on his part and all are equally cognizant of the fact that the average metal-working plants in France have a crying need for complete modern equipment if France is ever, in this line, to get and keep a place in the sun.

It is possible that the newly founded Société Anonyme de Credit a l'Industrie Française has some such plan in mind as will extend credit to French industrial plants that will enable them to add modern equipment where needed. The organization has just been brought into being by the collaboration of representatives of various metal-transforming industries, and one of the three great French banks, the Société Generale.

To establish the importance of the organization further, mention is made of the names of some of those associated with it: Paul Nicou, member of the Comité de Direction of the Comité des Forges; Marcel Champin, administrator of the French National Bank for Foreign Trade and of various metallurgical industries; Monsieur Dalbouze, president of the Syndicate of Electrical Machinery Constructors and also vice-president of the Union of Metallurgical Industries; and Monsieur Lambert-Ribot, administrator of various manufacturing plants including also among his functions administrator of the Syndical Chamber of Railway Material Constructors; and Theodore Laurent, president of the council of the Forges et Acieries de la Marine et Homecourt and the Lorraine Rombas Steel Works. Another important member of the committee is Monsieur Louppe, administrator of the Fives-Lille Locomotive Works and vice-president of the Syndicat des Industries Mecaniques.

It is readily to be conceived by a consideration of the names of those associated with the new organization that the importance of the interests which these men represent is such that this new credit organization has at least the elements in hand to develop French metal industries along any worth-while lines which may naturally suggest themselves.

It should not be ignored that credits are likely to be as applicable to the supply of raw materials from abroad where needed, as well as equipment and also for the financing of long-term sales at home and abroad and the carrying, if necessary, of stocks for the supply of current consumption orders which, so often in France since the war, have suffered long manufacturing delays in many lines where elsewhere such a practice is unknown. The whole scheme is in line with the new French industrial policy, now that the franc is stabilized and is not likely to fluctuate save in minor fractions based upon trade balances alone.

Labor Asks Its Share of "Mechanized" Profits

American labor welcomes the mechanicalization of American industry, with its attending increase of production, but insists on a fair and equitable share in the profits thus earned, William Green, president of the American Federation of Labor, told the International Association of Machinists in session last week at Atlanta, Ga.

Mr. Green made a strong appeal for a general adoption of the five-day week in industry. He cited figures to show that the production efficiency of workers, through the universal use of machinery, has increased in two decades past from 25 to 150 per cent.

"We are willing to shift the burden of human drudgery and toil from the shoulders of men and women to the machine." Mr. Green declared. "We would not stifle inventive power, but welcome it. But American labor insists that the owners of the machines shall not appropriate to themselves all the benefits that come through the introduction of machinery. We are steadfastly against any general reduction of wages for working men and women of the American continent."

Sales Conference Attracts Outside Speakers

Interesting papers were read by individuals not directly connected with the plating and polishing industry, but whose work brought them in contact with the broader subject of metal finishing, at the annual sales convention of the Hanson-Van Winkle-Munning Co., of Matewan, N. J., held at Asbury Park, Sept. 11-15. L. C. Morrow, managing editor of the *American Machinist*, spoke on "The Increasing Interest in Metal Finishing"; William M. Corse, consulting metallurgical engineer, spoke of the "Development of Business Through Research"; and Frederick G. Space, purchasing agent for the Seymour Manufacturing Co., spoke on "Sales Ethics."

Car Works to Be Enlarged

Plans have been completed for doubling the capacity of the Richmond Car Works, a subsidiary of the Standard Steel Car Co., of Pittsburgh, Pa., at a cost of $500,000. The company is producing between fifteen and twenty steel railway freight and coal cars a day, and is at work on an order from the Chesapeake & Ohio Ry. for 300 70-ton cars.

Increased German Purchasing Power Results in Augmented Imports

Machine tool imports from U. S. doubled in first half, 1928

By Our Berlin Correspondent

GERMANY'S foreign machinery trade was in the ascent in the first half of 1928. The growth of exports was slight, due to no inconsiderable degree to the share of the reparation supply; that of imports however was strongly marked.

The increase of imports is attributed to the following set of conditions: The vastly increased purchasing power of the German market, linked with the revived spirit of various enterprises; and the efficiency movement which naturally tends toward re-equipment of plants and constantly progressing specialization, which Germany's machine builders cannot hope to follow any more and which makes German industry more and more dependent on foreign products. Apart from that the contact between German manufacturers and the outside world is becoming closer from year to year due to more energetic efforts from both sides.

The development thus outlined is clearly illustrated by the following figures, showing the tonnage and the value of machinery imported into Germany in the first six months of the last six years.

Year	Metric Tons	Millions of Gold Marks
1923	2,670	...
1924	4,095	8.5
1925	16,814	33.2
1926	18,110	31.5
1927	22,187	47.4
1928	35,318	75.9

Machinery imports between January and June, 1928, taken *ad valorem*, are the highest on record. They surpass those of the last pre-war year, 1913, by 30 million marks. In tonnage however, they were behind the latter by 14,500 tons. This decrease, however, is solely due to the greatly diminished import of American agricultural implements, which are listed among machinery. In the first half of 1913, 18,400 tons of American harvesters were imported, while in the current year this figure dwindled down to 115 tons. With this item left out of account, a considerable growth of machinery imports becomes evident, even in comparison with pre-war times.

Some Notable Increases

Nearly all categories of machinery participated in the increase since last year. Particularly striking is the case of internal combustion engines for motor vehicles, the import of which has trebled and constitutes now the largest item in the import list. The growth of the import of tractors from 895 tons in 1927 to 2,139 tons in 1928 is also notable; that of machinery for cotton mills from 665 to 1,865 tons, of weaving looms from 1,706 to 4,032 tons, of metal-working machine tools from 1,633 to 2,590 tons and of mowers from 1,297 to 2,205 tons. The only notable decrease took place in the case of cotton spinning machines. Their import dropped from 3,106 tons in 1927 to 2,222 tons.

Germany's chief suppliers of machinery and the share they take in the import can be seen in the accompanying table.

The respective shares are larger than stated, because part of the machinery import is in the official statistics not specified as regards countries of origin.

America holds the front rank in volume as well as in variety of machinery procured from that country. Nearly all categories are represented in the list of imports. The most prominent items are tractors, internal combustion engines for motor vehicles and metal-working machine tools. The import of the latter has increased from 757 tons in 1927 to 1,572 tons.

In the import from Great Britain, textile machinery dominates, particularly cotton spinning machines and weaving looms. The volume of this import is growing from year to year, cotton spinning machines being the only exception. The increased import from Switzerland and from France is also notable. Switzerland supplies Germany with a great variety of machinery, chiefly such for the textile industry, silk and cotton mills, weaving looms, printing presses, machine tools and the like. The import of the latter is now larger than that from Great Britain. The formerly quite voluminous import of steam turbines from that country however is steadily diminishing.

Other Imports

France's main machinery export to Germany consists of engines for motor vehicles, textile machinery, and implements for the sugar industry. Canada supplies Germany with steam and motor plows and mowers; Sweden with cream separators, agricultural implements and woodworking machinery; Holland with dredgers; Austria with machine tools and printing presses; Czechoslovakia with weaving looms and sewing machines. The only supply procured from Italy are elevators, from Ireland machinery for linen factories, and from Norway woodworking machinery.

Listed among the German machinery import is the supply from the former German possessions, Alsace-Lorraine and the Sarre district. The detachment of those two countries has naturally resulted in a great shrinkage of former interstate commerce, but favored by the low value of the French currency a certain amount of trade, based upon old connections, is still kept up. Germany buys in Alsace-Lorraine chiefly textile machinery and from the Sarre district refrigerators, elevators and machines for the ceramic industry.

In a later article, an analysis will be made of the export situation.

German Machinery Imports January-June, 1928

Year	1928	1927	1926	1913
	Metric Tons			
Total	35,318	22,187	18,110	49,871
United States	8,745	3,936	3,573	23,577
Great Britain	6,076	5,137	6,548	13,163
Switzerland	5,344	3,216	2,035	2,512
France	2,460	979	523	272
Canada	1,620	977	326	3,161
Sweden	1,066	933	327	453
Holland	713	662	205	145
Czechoslovakia	622	355	315	611
Austria	392	315	99	
Belgium	613	356	125	469
Ireland	268	48	42	.....
Denmark	43	26	.....	56
Italy	90	.....	58	300
Norway	62	1	.....	.....
	28,114	16,941	14,176	44,719
Sarre	1,181	939	408	.....
Alsace-Lorraine	605	448	193	.....
Not specified	5,418	3,859	3,333	5,152

Fewer Industrial Disputes Chart Indicates

Chart No. 187, just issued by the National Industrial Conference Board, presents some of the official facts regarding industrial disputes (strikes and lockouts) compiled from various sources by official authorities in the United States and certain foreign countries in the period 1919 to 1927. The chart bears evidence of increasing harmony in industrial relations. As industry has settled down from the unusual conditions of war time, industrial warfare has diminished. Except for Great Britain's coal strike in 1926, and a somewhat irregular movement in Australia, the intensity of labor disputes has everywhere diminished.

In the United States, trades in which

disputes occurred and their causes are compared by number. The decrease during the period, very marked in the total, is shown to be largest in the metal trades. Questions regarding wages were proportionally as frequent a cause of dispute in 1927 as in 1914, but the number of disputes arising from such questions had greatly diminished last year.

Management Sessions in Chicago

The third technical meeting of the Institute of Management will be held at the Palmer House, Chicago, Monday, November 12. On the following three days, the autumn convention of the American Management Association will take place. The following tentative program has been prepared for these events.

MONDAY, NOVEMBER 12

Production Control of Research Projects, by C. W. Wilson, research manager, Pittsburgh Railways Co.

Scientific Methods Underlying the Preparation of the Valve and Fittings Index, by Joseph H. Barber, assistant to president, Walworth Co.

Methods of Determining Who Will Participate Under a Managerial Profit-Sharing Plan, by John S. Keir, economist, Dennison Manufacturing Co.

How to Prepare and Validate an Employee Test, by Eugene J. Benge, H. A. Hopf and Co.

TUESDAY, NOVEMBER 13

Functions of Presidents, Chairmen of Boards and Board Committees, by James O. McKinsey, James O. McKinsey and Co.

Research Activities of American Companies, by Dr. Z. C. Dickinson, professor of economics, University of Michigan, followed by leaders of discussion on the following themes:

Commercial and Sales Research.
Production Methods Research.
Office Methods Research.
Financial Research.
Personnel Research.

WEDNESDAY, NOVEMBER 14

Compensation of Executives.
Budgeting.

THURSDAY, NOVEMBER 15

Financial Aspects of Pension Plans, by Bryce Stewart, Industrial Relations Counselors, Inc.

Employment and Adjustment of Older Workers, by C. R. Dooley, manager personnel and training, Standard Oil Co. of N. J.

Trends in Industrial Health Practice. Report of a Committee presented by J. Walter Dietz, superintendent of industrial relations, Kearny Plant, Western Electric Co., Inc.

Discussion will follow under these subjects:

Maintaining Interest in the Health Program
The Company Physician as a Liaison Officer with Outside Offices and Physicians
An Experiment in the Treatment of Colds.

Foundry Equipment Orders Jump in August

According to figures furnished by the Foundry Equipment Manufacturers' Association, the index of gross orders for the month of August rose to 278, as against 94.8 for July and 106.4 for August, 1927. The greatest activity this year was in May, the figure being 335.6 due to large purchases by automotive plants, but the average figure has been more nearly 130 points.

Report Shows Decrease in Number of Factories

Reports on the 1927 Census of Manufactures which has been issued to date by the Census Bureau reveal some significant facts. During the two-year period between the 1925 and 1927 Census there was a noticeable decrease in the number of manufacturing establishments of approximately 2.6 per cent. If this rate of decrease established by the reports so far available is maintained, there was a decrease of about 5,000 manufacturing plants in the nation during the two-year period, bringing the number of establishments turning out products valued at over $5,000 to around 182,500, a decrease of about 31,000 plants since 1919. The number of manufacturing plants in the nation is slowly receding from the high point at the close of the war to the pre-war figure of 176,468 units.

An even more significant item is that pertaining to the increased installation of power per employee, that is, increased efficiency in industrial operations. During the two-year period between the 1925 and 1927 census the installed primary power per worker, as indicated by these preliminary reports, increased from 3.14 to 3.76 hp., or by approximately 20 per cent. It seems probable, however, that the industries so far reported are those having a comparatively low power installation per worker, since the installed primary power per worker for all industries in 1925 was 4.26 hp., materially above that of the industries which have been reported to date.

Reaffirmation of Milling Cutter Standards

Simplified Practice Recommendation No. 36 on milling cutters has been reaffirmed according to a report of the Department of Commerce after a survey of the degree of adherence had been made. It is not expected that any revision will take place until after the completion of the work of the sectional committee of the American Engineering Standards Committee on standardization of small tools and machine tool elements.

Industrial Group Formed of Southern Manufacturers

South, Inc., is an organization recently formed by a number of the larger manufacturing firms of the southern district at a meeting of the Southeast Shippers Regional Advisory Board, held at Biloxi, Miss., membership of the new organization including several of the leading industrial plants of the South in the machinery, iron and steel and other manufacturing fields. Its purpose is to develop further the business of these industrial concerns, especially the export volume. Some of the leading manufacturers of the district are included among the officers and directors of the corporation, and among other things it is expected to establish permanent representatives at New York, Chicago, London, Rio de Janeiro and in the Far East, to look after sales for member firms in these territories, giving particular attention to developing the export business of southern industrial concerns in the European, Latin-American and Oriental centers. Hugh Morrow, president of the Sloss-Sheffield Iron & Steel Co., Birmingham, Ala., is on the board of directors.

Ohio Foundries Association, Inc., Formed Recently

Announcement is made by the Ohio State Foundrymen's Association that the organization has been incorporated under the name of the Ohio Foundries Association, Inc. The officers of the corporation are: C. C. Smith, Toledo Steel Casting Co., president; D. McDaniel, Hamilton Foundry & Machine Co., vice-president; and E. Sands, Superior Gas Engine Co., treasurer. Due to the recent resignation of A. J. Tuscany, who served as secretary-manager of the Ohio Association, the selection of a successor is now being considered. Mr. Tuscany is now manager of the Gray Iron Institute, with headquarters in Cleveland.

Diesel Aircraft Engine Tested

The Packard Motor Car Co. has successfully completed service tests of a Diesel type aircraft engine and will shortly begin production. The new engine marks a revolutionary step in development of aircraft power, weighing less than 3 lb. per horsepower and carrying a plane 25 per cent farther with the same weight in oil fuel as compared with gasoline. The motor is of radial air-cooled type and develops 200 hp. with use of Diesel principle, with oil for fuel. The engine has no ignition system, spark plugs nor carburetor.

Paper on Ford Production at Coming S.A.E. Meeting

How the Ford Motor Co. gets its low production costs is to be explained in an address to be made by John Younger, of Ohio State University, at the annual production meeting of the Society of Automotive Engineers. A program is now being arranged for this meeting, which is scheduled for November 22 and 23 at the Book-Cadillac Hotel in Detroit. Some of the other subjects under consideration for papers and discussion are welding, honing, gear making, power transmission standards and the developing of production engineers.

Tractor Production High

Strong demand this year for power farming machinery has been reflected in business of the farm equipment companies making such products.

The International Harvester Co. is

now reported making 125 or more tractors a day at each of its three plants. Deere & Co. is developing its tractor division as never before. Advance-Rumely is reported behind on tractor and combine orders. At present it makes four sizes of tractors together with its new DoAll tractor. It makes three sizes of prairie combines and one size of hillside combine. Hart-Parr Co. is putting in an addition to its plant with a view to stepping up production Nov. 1. The company is now two months behind orders.

U. S. Exports Show Big Gain in First Half of 1928

American exporters did more business in the first six months of the year than in any twelve months period prior to the world war, as shown in a bulletin on "Our World Trade for January-June," recently issued by the Foreign Commercial Department of the Chamber of Commerce of the United States. Exports for the first half of the year, amounting to $2,377,533,000, were $11,000,000 greater than in the same period a year ago. The report also shows that the growth of American export business has been in volume as well as in dollar value.

Power-driven metal-working machinery gained in value over last year's period from $8,729,000 to $12,147,000, or 39.2 per cent. Construction and conveying machinery gained 36.8 per cent to $12,182,000 in value. Agricultural machinery gained 27.8 per cent; automobiles and parts, 17.2 per cent; calculating machines, 30 per cent; typewriters, 9.4 per cent; and structural iron and steel, 27.3 per cent. Iron and steel tubular products, however, fell 19.7 per cent in value, compared with the six-month period last year. In quantity, 779 external grinders were exported as against 547 last year, a gain of 42.4 per cent; and 996 lathes, as against 602, a gain of 65.4 per cent.

Canada, with a population of only 9,400,000 people, absorbed $429,199,000 worth of our exports, or 18.1 per cent, while the United Kingdom absorbed $384,457,000 worth, or 16.2 per cent. Germany ranked third in consumption with a value of $205,769,000, a gain of 11.5 per cent. Canada in return sold the United States more of its exports than any other country.

Chase Absorbs Waterbury and Hungerford Brass Companies

A recent announcement by F. S. Chase, president of the Chase Brass & Copper Co., Inc., states that all products formerly sold by the Waterbury Manufacturing Co. and the U. T. Hungerford Brass and Copper Co., will now be sold under the Chase name and mark. The new trademark is a figure, half horse and half man, with bent bow and drawn arrow, illustrative of the chase and so of the firm name. In addition to its use on all other products of the companies now amalgamated, it will appear on Alpha brass pipe.

The first and original plant of the Chase Companies, Inc., was the Waterbury concern which was founded in 1837. It was formerly called Hitchcock's, and later became known as the United States Button Co. In 1876 it was incorporated under the name of Waterbury Manufacturing Co., and in 1882 employed about 37 men.

So much brass was being used by 1900 that a new plant called the Chase Rolling Mill Co. was built to cast and roll the metal needed. Gradually this second unit of the company entered the market as producers of Chase brass sheet, rod, wire and tubing. Later, in 1910, a second brass mill, the Chase Metal Works, was founded. In 1917 these three plants were merged into the present Chase Companies, Inc. Four years later Chase brass and copper warehouses were started on the East and West coast, and additional warehouses were soon added in important manufacturing cities.

Last year the Chase Companies bought the assets of the U. T. Hungerford Brass & Copper Co., who also operated brass and copper warehouses in principal cities. Both the Chase and Hungerford chains of warehouses were united and merged into a separate company named the Chase Brass and Copper Co., Inc., which in addition to its warehouse business acts as the selling and distributing company for the Chase Companies, Incorporated.

Italian Metal-Working Industry Handicapped by Unstable Wage Scale

IN WHAT may be called a national pact, based upon the reform of the Italian monetary system, the stabilization of the lira finds one of its most striking manifestations in wages paid in the metal trades. The wage scale is based on so-called normal unit of wage, to which is added a temporary percentage and a further fluctuating increase taking into consideration the equally fluctuating cost of living. The normal wage rests fixed, but the global wage, so to put it, will accordingly vary. In one period the high cost of living element added as much as 43 per cent to the normal wage, but in May, 1927, this was reduced to 13 per cent only to rise a couple of months later to 15 per cent.

In the Biella district from 1924 to 1927 the wage of female workers ranged from 15 to 16.50 lire (where 80 per cent of the labor was performed by women) while male labor ranged from 18 to 21 lire. Today, on the new scale these figures have been reduced respectively to 12.40 lire and 15.50 lire.

These tentative wage scales are being discussed by the government, the employers, and employees syndicates in an effort to arrive at a just, if fluctuating base. At Genoa the syndicates of workers have accepted a further reduction of 1 lira per day. At Milan reductions have been accepted running from 0.70 to 0.40 lira. At Turin no definite accord has been reached to date.

Pourparleys still continue at Rome under the auspicies of the Minister of Corporations, but it is believed that matters will remain *status quo* for some months to come.

The important Ilva steel works in a recent report stated that the revalorization of the lire brought about a notable reduction in inventory values and has also brought about a virtual stagnation of production, which however is believed to be but temporary. Various other unfavorable conditions have affected the physical status of this company, largely owing, it is said, to the delay in adjusting salaries and wages in accord with the new monetary scale. Mention is also made of the dire effects of foreign competition and dumping, referring largely to imports from Germany and France and an interior competition which has nothing whatever to do with imports.

As a consequence, the current market price of semi-finished steel products is actually below production costs and without advantage save to the consumer. Essentially it has become a buyers' market.

The Ilva company report states that more than ever, owing to the monetary situation, it is necessary to reduce production costs to the lowest possible level and stabilize sale prices. Inspired by this principle the company has commenced to concentrate its labors and rationalize its production by the adoption of all needful methods and even preconceives the necessity of a national cartel on all items subject to either interior or exterior competition. Success has been obtained in certain compartments with regard to interior co-operation, but these accords have been but partial.

Italian steel manufacture and fabricating and transforming industries have developed their capacities beyond the actual output need. Of steel alone, it is claimed that Italian steel works can themselves produce today more than three million tons per annum in excess of the consumption of national production in 1927; in other words, more than double. To look long into the future—and perhaps not so long at that, knowing what the world does of Italian policies—it is believed that the closed door on steel and steel products from outside is about due. The League of Nations recommendations against restriction of imports and exports, of course, is directly antagonistic to such methods among its members, of which Italy is one.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

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THE markets are nearly all higher than they were a week ago. In each case, the advance is attributed to some technical development, but when a general rise in the price level reveals a preponderant disposition to buy, it is safe to assume that it bespeaks a preponderance of optimism.

Thus, securities are higher because there is a persistent belief that money will soon be cheaper, and corn is up because it has been discovered that it can be very profitably used to fatten cattle and hogs, if they can be sold at present prices. Wheat is also firm, because farmers are holding it, and the other grains have moved upward in sympathy with the prevailing tendency.

Cotton is nearly two cents above the season's low, on crop reports that are less favorable, and some improvement in the dry goods trade, plus the hope that the New Bedford strike will soon be settled. Sugar is commencing to resist the depressing influences that have caused the recent decline. The slight advance in rubber is said to reflect the prosperity in the motor industry and the largest automobile production on record.

Higher prices are being paid for iron and steel, and the mills are well employed. Copper is up to 15¼ cents on an improved demand, although the unmined supply is practically inexhaustible. Tin is also higher, on the rediscovery of a deficit that is really an old story to the trade.

Of distributive trade as distinguished from the commodities that are bought and sold for future delivery, it is not possible to generalize so positively. But there seems to be no doubt that business is improving and that merchants are buying more liberally. This is particularly true of cotton goods, and in a lesser degree of woolen fabrics.

Car loadings are increasing, and most of the corporations that report their sales of merchandise show a continued gain in business. It is not necessary to go into greater detail. There are some dark spots, but most of those who have a close-up of business in the United States will admit that it is generally good, and growing better. In other words, people are buying merchandise as well as stocks and bonds, although the demand for bonds has been somewhat checked by the high interest rates.

All this is satisfactory, and it seems to indicate activity for some time ahead. But change is the law of life, and the forward-looking man is now asking himself two questions. One has to do with the cause of our present prosperity, and the other with its probable duration.

Anyone who attempts to answer these two questions with finality is likely to make himself ridiculous, but the strength of the stock market in the face of tight money, and the buoyancy recently manifest in most of the commodity markets, gives color to the theory that the expansion of credit made possible by the centralization of the world's gold supply is chiefly responsible for the optimism and confidence that have now persisted for four or five years. Some call this expansion of credit "inflation," while others prefer a name that is less disparaging.

But the fact remains that the ability to borrow at some rate, however high, begets a confidence that men could never feel when they feared that it might become impossible to obtain credit at any price. In other words, the luxury of hope has now been put almost permanently at the disposal of those who may be willing to pay for it, and it is only when the price becomes prohibitive that enterprise will deny itself.

Hence, "Thinking makes it so," and it seems probable that the good times will continue until the world's supply of credit has been temporarily absorbed, and interest rates have reached a height at which it would be discreditable to borrow. That point has not been touched yet, nor is it in sight, but, with speculation and production increasing as they are at present the end may come sooner than now seems possible. Therefore, experience suggests that confidence and caution should go hand in hand. Meantime, it is worth observing that the markets show the effect of a conscious or subconscious disposition to exchange money for property. Of late, this disposition has become more noticeable in commodities than in securities. This is in accordance with the precedents, and with the assurance of farm relief that has been given by both Presidential candidates, very much higher prices for most agricultural products may be seen.

In Europe, conditions are very much as they are here, although business has not yet felt the full effect of the credit expansion that is in progress there. But there is no doubt that it has started, and that one result may be a better demand for our exportable surplus.

The decline in foreign exchange shows that the exportation of this surplus is already commencing, but the predictions that it would reattract some of the gold that we have parted with during the present year have not been realized.

The weekly statement of the Federal Reserve system shows an increase of $54,000,000 in brokers' loans as reported by the member banks in the New York district, but the reserve ratio of the entire system has risen 1.6 per cent during the week. The figures were without any pronounced effect, as the gain in the reserve ratio was regarded as an offset to the increase in brokers' loans.

WHAT'S DOING IN INDUSTRY

THE last quarter of 1928 is entered with considerable optimism by most machine tool builders and dealers, and there is little question but that the year in retrospect will have proved to have been an exceptionally good one. In most cases the volume of business done in all of last year has already been exceeded to date. September orders, while not equal in number to those of the banner month of August in most instances, were distinctly satisfactory to the trade. One of the most encouraging aspects of the situation is that the demand for equipment is so general and widespread.

NEW ENGLAND reports exceptional steadiness with active inquiry and most machine tool builders busy and complaining of the dearth of skilled workers. Similar conditions are found in Chicago and other centers. There and in New York used tools also are finding a ready market, the best in some time. The South, while not as active as other sections, is holding its own. Some of the new textile mills being established there are a source of some of the activity. Detroit also reports conditions steady, with emphasis on the unusual activity in the automobile shops which has resulted in so much business for machine tool builders everywhere. In Cincinnati a slight lull has been noted in the past week, but it is expected to be only temporary in character.

CANADIAN activity continues without abatement, one of the outstanding features being railroad equipment buying, including rails, rolling stock and tools. This phase of buying in the United States is light, but this week some of the railroads in Chicago and in the South are said to be buying against lists issued earlier.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHIGAGO

The closing days of September find conditions in the machine tool industry distinctly satisfactory to the trade. While the total volume of business for the month probably will not equal that of August, there will be but small difference—not more than 10 or 15 per cent according to those qualified to speak with authority. Inquiries have decreased somewhat, but shipments have been active. The demand has been general and widespread, industrialists contributing largely to the sales volume.

Railroads continue buying against lists issued within the last month, from time to time adding additional items to their requirements. In metal-working machinery, automatic screw machines still have a conspicuous place, manufacturers in a number of cases being unable to make anything like prompt deliveries although working their plants at high pressure. For woodworking machinery manufacturers, September has proved a banner month, due to increased building operations, especially in the construction of public schools. The call for used machine tools has been well maintained, and dealers in this line expect no immediate let up in demand. Forward looking machinery men anticipate that the level of business for October will continue on the same good level that has been maintained for the last three months.

DETROIT

Conditions in the machinery market here are still regular with no outstanding developments but a continuation of the general prosperity that has marked the trade during almost the entire year. Most of the automobile manufacturers are making purchases of equipment and, though none of the orders are very large at this time, there is every indication that bigger developments are in prospect and will be realized before the end of the year.

The Graham-Paige Motors Corporation is expanding steadily and is adding new equipment to take care of the unusual demands for its products. Chrysler and Dodge are also in the market, though mostly for small tools at this time. Chrysler has added a new line of "Fargo" trucks to its list of products. Ford is increasing his capacity and is making some purchases. All of the body companies are active and most of them are doing at least occasional buying.

The Clayton and Lambert Co., makers of auto body parts, hoods, fenders, all types of metal stampings and other products is building a new $1,000,000 plant and office building.

SOUTHERN DISTRICT

Machinery and machine tool business in the Southern district is about holding its own as compared with normal volume for this period, though few of the distributors are doing as much business as at this time last year, when sales were considerably better than normal. The outlook for fall trade seems fairly promising, but, due to the disrupting of general business and industrial conditions in the extreme Southeast by the recent Florida hurricane, the outlook is not as promising as it was a month or so ago in that district.

The furniture industries in the Georgia, Carolina and East Tennessee district are placing a fair volume of orders for woodworking machinery, with current sales to the woodworking industries in the Southeast about normal as a whole, but less than at this time last year. A fair number of orders are also reported in the textile mill field for some of the new mills now being erected in the South, but as a whole this business is less active than it was during the summer months. Some orders for heavier equipment are reported from railroads in this district in connection with new shop construction projects, but this business is also less than it was during the summer period. Some business also is reported for contractors' equipment as there is an unusual amount of new construction going on in the larger Southeastern cities.

In the garage and smaller machine shop field business is generally a little quiet, though some dealers report a few orders for used and rebuilt equipment from these buyers, though no orders of any great size.

NEW ENGLAND

Exceptional steadiness is a characteristic that aptly fits and describes conditions in the New England machinery and machine tool manufacturing field. A fine volume of sales was noted throughout September, especially for small machine units. This feature, together with a substantial balance of orders in progress for large machine tools, has enabled the industry to continue a high level of progress.

Inquiries during the week would indicate a better future for orders covering large production units. The automotive industry was again well represented and gives additional promise of new bookings in this line. The aeronautical, electrical and other metal-working industries were also prominent.

Manufacturers here are not worried over the future and look forward to a high measure of activity through the balance of the year. Overtime schedules in most plants are growing to be the rule rather than the exception, and there seems to be a dearth of skilled workers and tradesmen throughout Southern New England.

Dealers in rebuilt and used machinery report improved buying during the past seven days as compared with last week. One dealer, who previously expressed his doubts regarding September sales, was able to realize a satisfactory total volume, due to sales closed during the last few days of the month.

CINCINNATI

A slight lull in the past week is reported by the majority of the machine tool manufacturers in the Cincinnati district. A few concerns, however, report that they made a slight gain in the period and a few report that they held their own. There is no apprehension caused by the slight falling off in the demand, and it is thought that the market will revive in a few days.

Selling agents report that they held their own in the week and express the opinion that the demand is about to increase in local and adjacent territory. There is plenty of business pending, it is stated, and it is expected that considerable of this will be closed at an early date.

The principal buyers in the past week were general machinists and miscellaneous users, located in all sections of the country. While the great majority of the orders called for single tools, there were some that called for two or three pieces of equipment. The week's purchases were well diversified in the matters of sizes and types of tools. Scattering single purchases were made by concerns in the automotive field and allied trades and also by railroads. A few export orders of small size were also received.

Inquiries held up well during the week, both the manufacturers and the selling agents report, the great majority being for single items. The principal inquiries were general machinists and miscellaneous users, whose requirements were well diversified as to sizes and types. Inquiries from railroads, automobile manufacturers and concerns in the allied industries were largely confined to single tools.

CANADA

The high rate of activity which has characterized the metal-working industry generally in Canada during the last six months continues without any signs of abatement. Demand for iron and steel is steady. It is estimated that 80 per cent of four-quarter buying is completed. Several 2,000-ton orders have been booked besides a number of fairly large tonnages for delivery before the navigation season closes. Rail mills are still active and working at full capacity.

Railway equipment buying is an encouraging feature of the situation. The Canadian National Railways have made considerable purchases of machine tools and other equipment so far this year, and further large purchases are to be made. Sir Henry Thornton recently announced that the C.N.R. would require from $10,000,000 to $15,000,000 worth of new equipment on its next order. Substantial new business is also expected from the C.P.R. for the new year.

Manufacture of motor vehicles gives no sign of having reached a saturation point. In the month of August the activity of output for home and foreign trade was well maintained, being about two and a half times that of last August, and the outlook for the balance of the year is highly promising. It is reported that one of the leading automobile manufacturers has placed an order with the Cockshutt Plow Co. for truck bodies to the value of $1,000,000.

Reports continue from the West of the increased use of modern machinery in the agricultural sections. The importance of speed and the low-cost factor appear to assure a wide impetus in future buying of form machinery.

NEW YORK

The volume of machine tools sold in September by local dealers and factory representatives, while in general below the record months of July and August, was reported quite satisfactory and well above that of September, 1927. For some the amount of orders received in the past week was light, but no significance was attached to this condition as the prospects for the last quarter of the year are exceedingly bright. As has been reported for some weeks, buying is well scattered and well diversified, indicating general industrial activity.

About the only large inquiry out is for approximately eight planers required by R. Hoe & Co. for their new quarters in the Bronx. Rumor has it, however, that the original list will be considerably reduced in favor of planer-type millers. Preparations by E. W. Bliss for the production of the Bristol air-cooled radial aircraft engine are also finding interest among the trade. A few small orders for equipment have been

placed already, and blueprints are being studied by others to determine the specific requirements of manufacture.

As far as industrial activity goes, the Hyatt Roller Bearing Co. appears to be one of the most active from a production point of view, but is apparently meeting its requirements with present equipment. Certain departments of the plant are operating on a 24-hr. basis.

Used and rebuilt equipment is finding a ready market, one of the best in some months, according to one firm interviewed.

The Triplex Machine Tool Co. reports the sale of a Swiss jig borer to a large manufacturer in New York State, a 6-in. vertical slotter to a New Jersey firm, six large flexible power presses, and some smaller sales.

The Pratt & Whitney Co. reports the sale of a 13 x 30-in. lathe, four 13 x 36-in. lathes, one 16 x 84-in. lathe, a No. 10 hand miller, an 8-in. rotary surface grinder, two 14-in. vertical surface grinders, an automatic worm grinder, a 3A universal die sinker, a No. 2 jig borer, and a 12-in. vertical shaper. The Niles Tool Works Co. sold a No. 3 heavy axle lathe, a combination journal-turning and axle lathe, and two 30-in. x 22-ft. Timesaver lathes. The machinery division of the company sold a 3-ft. high-speed Morris radial drill, a 4- and a 5-ft. heavy-duty Morris radial drill, a Cincinnati automatic tapper, a Cincinnati high-speed 4-spindle drill, a Ransome grinder, and a Boye & Emmes 18-in. x 12-ft. lathe.

Southern Pig Iron Sales Reach Peak

According to information received the latter part of September from industrial sources at Birmingham, Ala., sales of pig iron by producers in the Alabama territory have reached the largest volume in some months, with bookings and shipments both well in excess of the current output by blast furnaces in the state, and indications giving promise of continued heavy demand through the last quarter of the year. The stove manufacturing industries in the Southeast are reported to be unusually heavy buyers at this time among the smaller-tonnage purchasers, while sales to cast-iron pipe and fittings manufacturers in the Southeast are also better than normal for this period, and in the general foundry field also exceed normal. As a whole, the metal trades industries are reported to be operating in the South at this time on a very active basis, considerably heavier than at this time last year with most of the plants well sold ahead. Prices in the pig iron market are reported showing steady advances due to the increased demand.

Lowest Number of Locomotives in Need of Repair

With only 7,954 locomotives, or 13.4 per cent of the number on line, in need of repair on September 1, a new low record for all times was established by the railroads of this country, despite the fact that freight traffic is always heavier at this time of the year than at any other. This number was a decrease of 873 locomotives, compared with the number in need of repair on August 15, and the record more than reaches the goal of 15 per cent set by the railroads in 1923, when a program was adopted by them calling for the maintenance of efficient service.

Exhibits of American Firms Invited in Calcutta Show

The All-India Industrial Exhibition, an annual affair in India, will be held this year at Calcutta during December, under the auspices of the Indian National Congress, states a report from Vice-Consul Winfield H. Minor, Calcutta, made public by the Department of Commerce. Manufacturers of industrial machinery in the United States are being invited to participate in the exposition. According to the secretary of the exhibition there is a fairly large potential market in India for industrial machinery of practically all types. The exhibition will open on December 15, and will continue until January 15, 1929.

Timken Output High

The Timken Roller Bearing Co. has established a new record in output last month when approximately 2,250,000 roller bearings were shipped to motor manufacturers. The company's output will take care of the requirements of a large majority of motor manufacturers outside the General Motors group. Shipments to Ford Motor Co. have been increasing with indications that heavy demand from this quarter will continue during the fall months. Chrysler and Dodge specifications are also at peak levels. In August, Timken produced slightly under 2,000,000 bearings. Expansion of the company's plant at Canton, Ohio, will be completed this year and will add considerably to productive capacity.

Ford to Make Shock Absorbers at Green Island

The Green Island (N. Y.) plant of the Ford Motor Co. is to become the center of the manufacture of the Houdaille shock absorber under permit of the Houde Co., of Buffalo. Ford has heretofore purchased this accessory from the Buffalo concern. Five hundred additional employees will be added to the Green Island plant, making the total number 1,300. New machinery to make the shock absorbers is now on its way to Green Island and will be installed immediately. The new department will use 40,000 sq.ft. of floor space, formerly occupied by the sales and service division of the Ford company. The production at the outset is to be 6,000 units a day, on a 24-hr. basis.

Aeronautical Firms Buy One-Third Interest in Scintilla Magneto

A stock purchase was recently concluded in which the Curtiss Aeroplane & Motor Co., Inc., the Wright Aeronautical Corporation and Pratt & Whitney Aircraft Co. jointly secured a third interest in the Scintilla Magneto Co., of Sidney, N. Y. One of the purposes of the purchase is said to be to provide funds for expanding production and for development work. A new factory building of 40,000 sq.ft. is now under construction. The present output at Sidney is 100 magnetos per day, and about 350 persons are employed.

Three new directors of the Scintilla company representing the engine manufacturer were elected following this stock purchase. Frederick B. Rentchler, president, Pratt & Whitney Aircraft Co.; Frank B. Russell, vice-president, Curtiss Aeroplane & Motor Co., Inc., and Richard F. Hoyt, chairman of the Wright Aeronautical Corporation.

William Flook, president of the American Brown-Boveri Electrical Corporation, was elected to the presidency of the Scintilla company in place of Lawrence R. Wilder. T. Z. Fagan, and H. Hanni, vice-presidents, and George Steiner, secretary and treasurer, were re-elected.

Canadian Auto Production

Production from the automobile parts and accessories industry of Canada during 1927 was valued at $14,862,616, an increase of 7 per cent over the $13,914,965 reported in 1926, which in turn was 15 per cent better than 1925, according to reports issued by the Dominion Bureau of Statistics.

Ryerson Acquires Sanderson Plant and Warehouse

Joseph T. Ryerson & Son, Inc. of Boston, New York, and Chicago, has acquired the plant, merchandise, and good will of the E. P. Sanderson Co., at Third, Binney & Munroe Streets, Kendall Square, Cambridge, Mass. The Sanderson plant is one of the largest and most complete of its kind in the New England territory. The Ryerson company has been operating on leased property at 675 Concord Ave., Cambridge, since May, 1926. By the combination with the Sanderson organization and the addition of new lines, the Ryerson concern will be in a better position to supply iron and steel products on short delivery than before.

Personals

WILLIAM H. FRENCH, formerly general foreman of the De Laval Separator Co. of Poughkeepsie, has recently accepted a position as superintendent for the Graham & Norton Co. of New York, N. Y.

A. H. TISCHER, 704 N. Alabama St., Indianapolis, Ind., has been appointed representative of the Foote Bros. Gear & Machine Co., of Chicago, in the Indiana territory south of Ft. Wayne and including Louisville, Kentucky.

R. W. PIPER will represent the Wagner Electric Corporation, of St. Louis, in its transformer sales division, in the Southeast. H. T. Epting has been transferred from the Philadelphia office to the Atlanta sales office of the corporation.

W. A. MAXWELL, production manager of the Colorado Fuel & Iron Co., has been appointed vice-president, filling the vacancy caused by the resignation of E. H. Wetzel. Mr. Maxwell will also continue as production manager.

GRAHAM G. GROSVENOR, formerly vice-president of the Otis Elevator Co., New York, has been made president of the Fairchild Airplane Co., a subsidiary of the Fairchild Aviation Corporation, Farmingdale, Long Island.

D. WALKER WEAR has been elected president of the Stow Manufacturing Co., of Binghampton, N. Y., to fill the vacancy caused by the death of C. F. Hotchkiss on Sept. 9. Mr. Wear had been vice-president.

GEORGE L. BITTING, director of sales of the Bunting Brass and Bronze Co., has resigned, effective immediately. Mr. Bitting has made no immediate plans for the future and will remain at his home in Toledo, Ohio, for a time.

KENNETH B. SPAULDING, formerly sales manager of the McCrosky Tool Corporation, Meadville, Pa., has been named sales manager of the Wesson Sales Co., of Detroit, agent for Eclipse Interchangeable counterbores, Bath ground taps, and Widia metal, the last of the Krupp Works, Germany.

LEIGHTON W. ROGERS has been appointed executive officer of the International Aeronautics Conference to be held in Washington, Dec. 12-14. He will work under the direction of an executive committee headed by Asst. Secretary of Commerce for Aeronautics, W. P. McCracken, Jr.

R. W. STRAUD, advertising manager of the Benjamin Electric Co., Chicago, has been elected second vice-president of the Engineering Advertisers' Association of Chicago. He fills the vacancy left by the resignation of G. C. Williams, of the Northwest Engineering Co., Inc., Chicago.

W. H. CRAWFORD, formerly secretary-treasurer of the Reliance Manufacturing Co., manufacturer of spring lockwashers, has been made president in place of F. C. McLain, retired. H. J. McGinn, formerly general sales manager, has become vice-president and general manager in place of E. W. Hart, retired.

PROF. FRANK MCKIBBEN, consulting structural and bridge engineer, has started on a lecture tour of the principal cities of the United States. He will talk on the application of electric arc welding to the construction of buildings, based upon the experience of the General Electric Co. and other concerns in this field. He will lecture before local sections of engineering societies, and his tentative program includes dates up to March 4, 1929.

F. R. FISHBACK, president of the Electric Controller & Manufacturing Co., Cleveland, has been elected vice-president in charge of the Apparatus Division of the National Electrical Manufacturers Association in place of N. A. Wolcott, resigned. Mr. Fishback has held the position of sales manager of the Electric Controller company and in 1924 was appointed vice-president and secretary. In 1925, he was elected president, his present title.

ALLEN H. WARNER, vice-president and general manager of the H. B. Sherman Manufacturing Co., Battle Creek, Mich., has been elected president in place of the late Howard B. Sherman, founder of the organization. At the same meeting of the board of directors, Donald P. Ordway, a director, was elected vice-president. Gordon E. Townsend remains as secretary-treasurer. The company manufactures brass goods and has just passed through one of its most successful periods, with bright prospects ahead.

Business Items

The Bassic Manufacturing Co., of 2650 N. Crawford Ave., Chicago, has changed its name to Alemite Manufacturing Corporation, its address remaining the same.

The Selco Tool & Die Co., of New York City, has been incorporated through J. E. Amkus, attorney, 49 W. 71st St., with $10,000 capital.

The Ohio Service Tool & Die Co., Toledo, Ohio, has been incorporated with $25,000 capital by Adolf Burkin, Howard O. Scheerer and George L. Oberle.

Headquarters for the executive offices, sales, engineering and planning departments of Gears and Forgings, Inc., have been centralized at Cleveland in a recently erected administration building of three floors.

Because of the rush of orders being received at this time, the Spicer Manufacturing Co. is expected to delay until Jan. 1, the removal of its executive offices from Plainfield, N. J., to Toledo, Ohio.

The W. A. Leonard Machine Co., Danbury, Conn., has incorporated with a capital of $50,000 to manufacture machinery and tools. The incorporators are: William A. Leonard, Helen V. Leonard, and Madlyn R. Murphy, all of Danbury.

The Hazard Wire Rope Co., Chicago, has removed its office and warehouse to 654 West Lake St., where it will occupy the entire first floor and basement, with additional space extending through to Lydia Court.

The H. D. Smith Co., Plantsville, Conn., one of the oldest foundries in the country, which was scheduled to be sold at auction September 25, will not be sold until October 25. Originally the plant was to be sold June 1 and the latest adjournment is the second.

The Strong-Scott Manufacturing Co. of Winnipeg, Manitoba, has erected another machine shop and has installed modern equipment for the rapid handling of process work. The concern has also greatly enlarged its sheet metal shop by the addition of a number of new machines.

The Kroeschell Boiler Co., 4311 Diversey Ave., Chicago, has been incorporated to manufacture and deal in boilers, tanks, heaters, etc. Capital $20,000 common, and $150,000 preferred. Incorporated: C. A. Rochlitz, Carl H. Kroeschell, Fred Lautenschlager.

Directors of Lackey Foundry & Machine Co., of Detroit, on Sept. 20 declared a regular quarterly dividend of 50 cents per share, thus placing the stock on a regular $2 annual basis compared with the previous annual rate of $1.20. In addition, directors declared an extra dividend of 10 cents per share.

Articles of incorporation have been issued to the Productive Equipment Corporation, 134 N. La Salle St., Chicago. The company will manufacture and deal in vibrating screens and separators and other mechanical devices. Capital, $250,000. The incorporators are: Lewis E. Soldan, John L. Westonhaver and John L. Devlin.

Letters of incorporation have been issued to the American Ironing Machine Co., 100 E. Ohio St., Chicago. The company will manufacture and deal in laundry machinery and equipment. Capital, $225,000 preferred, and 50,000 shares non-par value common. The incorporators are: W. T. Peter, E. C. Peter and M. J. Broderick.

Work has commenced on the rehabilitation program of the Steel Co. of Canada, at Hamilton, Ontario, which is expected to cost $6,000,000, exclusive of the $1,000,000 harbor development being undertaken by the company. Two open-hearth furnaces are to be added. The 14 and 10-in. rolling mills will be replaced with a modern combination 12 and 10-in. train.

The Falk Corporation of Milwaukee, has appointed B. W. Rogers, of 225 Central Savings & Trust Bldg., Akron, Ohio, as representative for the Akron territory. Mr. Rogers had formerly been connected with the B. F. Goodrich Co. in that city and before that period, the Allis-Chalmers Manufacturing Co. He will handle Falk herringbone gears, speed reducers and flexible couplings.

At a recent meeting of the directors of the Dominion Radiator and Boiler Co., Limited, plans were approved for extensive improvements in both manufacturing plants of the company. An appropriation of $500,000 was made to carry out these improvements. Approximately 60 per cent of the appropriation will be spent on the Toronto plant. The balance has been allotted to the plant located at Brantford, Ontario.

The Cotta Gear Co., 117-129 Morgan St., Rockford, Ill., has increased its capitalization from $30,000 to $200,000 to provide facilities for increased production of its new five-speed transmission, Charles Cotta, president announced last week. The firm has been reorganized to include George F. Colton, president of the Crumb-Colton Co., who becomes secretary. L. P. Cotta is treasurer. Capacity of the firm, it is expected, will be tripled next year. The new transmission will be built for trucks and buses and for rail cars, the only transmission on the market in which more than four speeds are operated by one lever.

An entire block adjacent to the plant of the Blackhawk Foundry & Machine Co., Davenport, Iowa, and the intervening street have been acquired by the company to provide for future growth. The corporation now owns nearly 5 acres of land, 3 acres of which are occupied by its gray iron and aluminum casting plants, the later being one of the largest Middle West aluminum smelters outside the Chicago district. Business this year, it is reported, is 33 per cent ahead of the same period last year.

Obituaries

LEONARD SANFORD TYLER, vice-president of the Acme Wire Co., New Haven, Conn., died September 24, following an extended illness. Mr. Tyler was 47 years old and had been with the wire company 18 years. He was a graduate of Andover Academy and Yale University in 1905. Mr. Tyler was a director of the Morris Plan Bank and vice-president and director of the National Electric Condenser Company.

Forthcoming Meetings

National Safety Council. Seventeenth annual safety congress to be held in New York, October 1-5. W. H. Cameron, managing director, 108 E. Ohio St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Welding Society. Fall meeting and exposition, Exhibition Hall of Commercial Museum, Philadelphia, Pa., Oct. 8-12, in conjunction with "National Metals Exposition" of the American Society for Steel Treating. Miss M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals. Division of American Institute of Mining and Metallurgical Engineers. Annual fall meeting during National Metal Week, Oct. 8-12, Benjamin Franklin Hotel, Philadelphia. W. M. Corse, secretary, 810 18th St., N. W., Washington, D. C.

American Gear Manufacturers' Association. Semi-annual meeting, including joint session with the Machine Shop Practice Division of the American Society of Mechanical Engineers, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

Society of Industrial Engineers. Fifteenth annual convention, Rochester, N. Y., October 17-19, in conjunction with the Industrial Management Council of the Rochester Chamber of Commerce. George C. Dent, executive secretary, 205 Wacker Drive, Chicago.

National Manufacturers' Association. Combined assembly with the National Industrial Council in New York City, October 22-24. George S. Doudinot, secretary, 11 W. 42nd St., New York City.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section host, 7 S. Dearborn St., Chicago.

Society of Automotive Engineers. Production meeting, Book-Cadillac Hotel, Detroit, Mich., Nov. 22-23. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

The Weekly Price Guide

Rise and Fall of the Market

FIRMNESS prevails in prices of iron, steel and non-ferrous metals in the current market. The trend in pig iron has been definitely upward during the last three weeks. Steel demand is particularly active at present in sheets, railway and automotive material, while buying of steel pipe remains seasonally quiet. Steel mill operations in the chief producing districts, such as Chicago, Pittsburgh and Youngstown, are at about 85 per cent of capacity, with a tendency to gain.

(All prices as of Sept. 28, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.12
BIRMINGHAM	
No. 2 Foundry	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.51
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. o 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.40@2.45	3.60	3.20	4.00
No. 22	2.55@2.60	3.75	3.35	4.15
No. 24	2.60@2.65	3.80	3.40	4.20
No. 26	2.70@2.75	3.90	3.50	4.30
No. 28	2.85@2.90	4.05	3.65	4.45
Galvanized				
No. 10	2.80@2.95	3.95	3.55	4.25
Nos. 12 to 14	2.90@3.05	4.05	3.65	4.35
No. 16	3.00@3.15	4.15	3.75	4.45
No. 18	3.15@3.30	4.30	3.90	4.60
No. 20	3.30@3.45	4.45	4.10	4.75
No. 22	3.35@3.50	4.50	4.15	4.80
No. 24	3.60@3.70	4.65	4.25	4.95
No. 26	3.75@3.90	4.90	4.50	5.20
No. 28	4.00@4.15	5.15	4.75	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
¾	.58½	2.875	2.469	.203
1	.76½	3.5	3.068	.216
1¼	.92	4.0	3.548	.226
1½	1.09	4.5	4.026	.237
1¾	1.27	5.0	4.506	.247
2	1.48	5.563	5.047	.258
2½	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

——Thickness—— Decimal	B.w.g. and Fractions	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.75
Tin, Straits, pigs, New York			50.50
Lead, pigs, E. St. Louis	6.32½	New York	8.00
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.25	13.00	14.25
Copper sheets, base	23.75	23.50	23.75
Copper wire, base	20.37½	19.62½	17.00*
Copper bars, base	22.25	22.00	22.75
Copper tubing, base	25.25	25.00	25.25
Brass sheets, high, base	19.50	19.25	19.50
Brass tubing, high, base	24.37½	24.12½	24.37½
Brass rods, high, base	17.25	17.00	17.25
Brass wire, high, base	20.00	19.75	20.00

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	10.01
Solder (⅓ and ½).....	34.00	30.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade.....			67.75
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	13.12½@13.37½	12.00	12.25@12.75
Copper, heavy, and wire..	12.12½@13.12½	11.25	11.62½@12.00
Copper, light, and bottoms	11.00 @11.25	9.75	10.50@11.00
Heavy lead.....	5.25 @ 5.50	5.25	4.75@ 5.25
Tea lead.....	3.50 @ 4.00	3.75	3.75@ 4.25
Brass, heavy, yellow.....	7.25 @ 7.50	7.75	7.50@ 8.00
Brass, heavy, red.....	9.75 @10.25	10.00	10.00@10.50
Brass, light.....	6.00 @ 6.25	16.25	6.50@ 7.00
No. 1 yellow rod turnings.	8.00 @ 8.50	7.75	8.00@ 8.50
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15½	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.105	.105	.107
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade.....	30–10%	30–10%	35%
Heavy grade.....	25–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.1725	.17	.16
Solder (⅓ and ½).....	per lb....	.34	.3225	.385
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.05	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	30–10%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$4.29	$4.29	$4.29
*Emery paper.....	10.71	10.71	10.71
†Emery cloth.....	20.97	20.97	20.97
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.32	1.32	1.32
Cloth.....	3.05	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.75@3.00		
Coke, prompt foundry, per net ton...	Connellsville, 4.00@4.50		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.25	
Red lead, dry.....	100 lb. kegs....	New York, 13.25	
Red lead, in oil.....	100 lb. kegs....	New York, 14.75	

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1⅛ and 1¼ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including 7/16-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., San Francisco — City, L. Leavy, Purch. Agt.—will receive bids until Oct. 22, for machinery and equipment for general shops and sheet metal equipment for Daniel Webster Jr. high school also sheet metal equipment for Ethan Allen school.

Mich., Detroit—Gannon Machine & Motor Co., 651 Plum St.—lathe and drill press.

Mich., Detroit — Graham Paige Motors Corp., 8505 West Warren Ave.—equipment for testing automobiles for proposed 2 story, 100 x 480 ft. auto testing building on Lonyo Rd. Estimated cost $200,000.

Mich., Detroit—Lincoln Mfg. Co., 2630 Erskin St.—miscellaneous equipment for the manufacture of electrical supplies for proposed 4 story, 85 x 100 ft. addition to factory. Estimated cost $70,000.

Mich., Detroit—Monarch Tool & Mfg. Co., 2704 East Larned St.—screw machine capacity not under 1¼ in.

Mich., Flint—A. C. Spark Plug Co., Harriet and Industrial Ave.—ovens for heat treating process for proposed 1 story, 144 x 275 ft. factory for die casting department and heat treating. Estimated cost $150,000.

N. Y., New York—P. J. Dooling, Comr. of Purchase, Municipal Bldg., will receive bids until Oct. 9, for compressor and planer for Dept. of Plant and Structures.

Ont., Hamilton—National Steel Car Co., Kenilworth Ave.—machinery and equipment for a 1 story, 75 x 100 ft. addition to forge shop. Estimated cost $25,000.

Ont., London—T. C. Ivinson, 314 Piccadilly St.—complete equipment for proposed 4 story, 71 x 90 ft. garage and repair shop, gas service station, etc. Estimated cost $60,000.

Ont., Walkerton—Larsen & Shaw Ltd.—machinery and equipment for the manufacture of automobile parts to cost $15,000.

Opportunities for Future Business

Calif., Los Angeles—Central Manufacturing District Corp., Loma Vista, awarded contract for a 1 and 2 story 100 x 200 ft. addtion to warehouse and office, etc.

Calif., San Francisco — Premier Bed & Spring Co., 5700 Third St., awarded contract for a 1 story addition to factory at Third and Bancroft Sts. Estimated cost $60,000.

Conn., Bristol—New Departure Mfg. Co., N. J. Voorhees, 269 North Main St., awarded contract for a 1 story, 125 x 200 ft. machine shop on North Main St. Noted Sept. 20.

Fla., Jacksonville—Kirby-Nolan Co., will soon award contract for a 3 story, 104 x 125 ft. sales and service building. C. B. Schoeppl, Consolidated Bldg., Archt.

Ill., Chicago—General Laundry Machine Co., 1223 South Talman St., plans addition to factory. Estimated cost $100,000. F. E. Davidson, 53 West Jackson Blvd., Archt.

Ill., Chicago—Martin Machine Works, 228 Laflin St., awarded contract for the construction of a 1 story machine shop in 2234 Walnut St.

Ind., Indianapolis—Wheeler-Schebler Co., 1302 Barth Ave., is receiving bids for the construction of a carburetor factory. Estimated cost $50,000. D. A. Bohlen & Son, 1001 Majestic Bldg., Archts.

Ia., Des Moines — J. I. Case Threshing Machine Co., c/o J. W. Work, 102 8th St., is having preliinary plans prepared for a 4 story, 106 x 130 ft. addition to factory. Estimated cost $80,000. C. V. Johnson, 502 Commonwealth Bldg., Archt.

Md., Baltimore—International Harvester Co., 81 Mosher St., awarded contract for a 1 story, 125 x 260 ft. service station at 25th and Kirk Sts. Estimated cost $105,000. Noted Sept. 20.

Md., Baltimore — Locke Insulator Corp., Charles and Cromwell Sts., will build a 2 story, 73 x 115 ft. laboratory building. Estimated cost $40,000.

Mass., Belmont (Boston P. O.) — City, c/o H. T. Underwood, 46 Cornhill, Boston, Archt., is receiving bids for the construction of a 1 story repair and service garage on Waverly St. here. Estimated cost $40,000.

Mass., East Milton (Boston P. O.)—M. Greenspan, 161 Devonshire St., Boston, will build a 1 story garage, etc. here. Estimated cost $150,000. Blackall, Clapp & Whittemore, 31 West St., Boston, Archts. Noted June 28.

Mass., Medford — Willard Welch Realty Co., 209 Washington St., Boston, is receiving bids for a 1 story, 60 x 80 ft. repair and service garage on Main St. here. Estimated cost $40,000. C. F. Springall, 84 Sprague St., Malden, Archt.

Mass., Newton (Boston P. O.)—Davidson Fan Co., 15 Brook St., awarded contract for a 2 story, 50 x 100 ft. factory on California St.

Mass., Quincy (Boston P. O.)—J. Grossman, 19 Glendale Rd., awarded contract for a 1 story, 50 x 160 ft. garage and repair shop on Washington St. Estimated cost $50,000.

Mass., Taunton—H. Jones, 93 Hart St. awarded contract for the construction of a 1 story, 75 x 100 ft. repair and service garage on County St. Estimated cost $40,000. Noted July 26.

Mich., Detroit — Briggs Mfg. Co., 11631 Mack Ave., awarded contract for a 1 story 140 x 370 ft. addition to auto body factory on Warren Ave. Estimated cost $80,000.

Mich., Detroit—Fisher Body Corp., General Motors Bldg., awarded contract for a 1 and 2 story, 100 x 800 and 40 x 100 ft. factory on French Rd. Estimated cost $500,000. Clayton Lambert Co., Beaubien St., manufacturers of gasoline torches, etc., lessee. Noted Sept. 27.

Mich., Detroit—J. M. Smith Co., 5914 Federal Ave., manufacturers of automobile parts, awarded contract for a 2 story, 80 x 150 ft. factory.

N. J., Paterson — J. D. Lugosch, 744 Bergenline Ave., Union City, Archt., is receiving bids for a 1 story, 154 x 200 ft. garage on Park Ave. for R. Atkins, 411 East 41st St. Estimated cost $150,000.

N. Y., Astoria — Klein Iron Works, 65 Broadway, Astoria, plans the construction of a 1 and 2 story, 101 x 139 ft. factory and office. Estimated cost $82,000. Private plans.

N. Y., Brooklyn—American Can Co., 120 Broadway, New York, plans the construction of a 4 story, 90 x 200 ft. factory at Wythe Ave. and North 3rd St. Estimated cost $227,000. Turner Construction Co., 420 Lexington Ave., Archt. and Engr.

N. Y., Brooklyn—Improved Cinders Co., 90 West St., New York, plans the construction of a 2 story, 24 x 132 ft. cinder reducing metal plant at Van Dam St. and Newton Creek. Estimated cost $50,000. Kleinert & Klie, 250 Park Ave., New York, Archts.

N. Y., Brooklyn — Marion Reid Garage Inc., L. Rosenberg, Pres., 391 Fulton St., will build a 2 story, 100 x 159 ft. garage at Atlantic and Brooklyn Aves. Estimated cost $100,000. Kleinert & Klie, 250 Park Ave., New York, Archts. Noted Sept. 13.

N. Y., Brooklyn—Metropolitan Construction Co., C. Simonelli, Pres., plans the construction of a 3 story, 50 x 100 ft. addition to factory at Metropolitan Ave. and Catherine St. Estimated cost $45,000. Laspia & Samenfeld, 269 Broadway, Archts.

N. Y., Brooklyn — L. Sarkin, 1744 East First St., plans the construction of a 2 story, 70 x 196 ft. garage at Prospect Ave. W. and 6th Ave. Estimated cost $60,000. Cohn Bros., 361 Stone Ave., Archts.

N. Y., Brooklyn—Weisbraun Realty Corp., S. Braun, Pres., 435 Beach 36th St., Edgemere, L. I., plans the construction of a 1 story, 150 x 175 ft. garage on Erasmus St. here. Estimated cost $70,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Long Island City—Sarkisan Realty Co., 13th St. and East River, New York, awarded contract for a 2 story garage, etc. at Queens Blvd. and Van Pelt St. here. Estimated cost $75,000.

N. Y., New York—I. Shermon, 1136 Fox St., will build a 50 x 107 ft. garage at 167 and 168th Sts. Estimated cost $55,000. Bleich & Gottlieb, 708 East Tremont St., Archts. Noted Sept. 20.

O., Cleveland—Cleveland Clinic Foundation, East 93rd St. and Euclid Ave., awarded contract for a 2 story, 100 x 300 ft. garage and service building at Carnegie Ave. and East 90th St. Estimated cost $200,000.

O., Cleveland—The Eaton Axle & Spring Co., C. I. Ochs, Pres., East 65th St. and Central Ave., had plans prepared for a 1 story, 330 x 400 ft. factory at East 140th St. and N. Y. C. R.R. Estimated cost $500,000. G. S. Rider & Co., Century Bldg., Archts.

O., Cleveland—Forest City Walworth Run Foundries Co., W. J. Strangward, Pres., 2500 West 27th St., awarded contract for rebuilding 4 story factory destroyed by fire. Estimated cost $50,000.

O., Cleveland—Gears & Forgings Inc., 3010 Woodhill Rd., had plans prepared for a 3 story, 72 x 72 ft. addition to factory. Estimated cost $50,000. Carter-Richards Co., 622 Engineers Bldg., Archts. and Engrs.

O., Dayton—G. R. Boeckling Motor Co., 1900 East Third St., plans the construction of a 2 story, 75 x 150 ft. garage and repair shop. Estimated cost $100,000. Private plans.

O., Dayton — Delco-Remy Co., 329 East First St., (subsidiary of General Motors Corp.), awarded contract for the construction of a 1 story, 75 x 120 ft. factory for the manufacturer of shock absorbers, etc. Estimated cost $50,000.

O., East Cleveland—Bd. of Education, C. Tilden, Dir., Shaw and Euclid Aves., plans an election Nov. 6 to vote $580,000 bonds for addition to Calendonia school, including warehouse and shop building on Elderwood Ave. Architect not selected.

O., Youngstown — Pfau Motors, Inc., awarded contract for a 1 story, 60 x 180 ft. garage on Wick Ave. Estimated cost $40,000.

Pa., Connellsville — West Pennsylvania Power Co., West Pennsylvania Bldg., Pittsburgh, will build a 1 story, 100 x 250 ft. garage and warehouse here. Estimated cost $150,000.

Pa., Philadelphia — W. Freihofer, 20th and Indiana Sts., will soon receive bids for a 2 story, 100 x 203 ft. garage at Grange and Conlyn Sts. Estimated cost $200,000. K. Fatto, 1828 Arch St., Archt.

Pa., Philadelphia — Morris Wheeler Co., 20th and Locust Sts., plans the construction of a garage, office, etc. at Fox St. and Roberts Ave. Estimated cost $1,500,000. J. S. Simsohn, Broad St. and Girard Ave., Engr.

Tex., San Antonio—M. A. Childero, et al., plans the construction of a basket and crate factory. Estimated cost $150.000.

Ont., Galt — Dominion Tack & Nail Co. awarded general contract for a 1 story addition to factory on Dundas St. Estimated cost $40,000.

Ont., Leaside—Durant Motors of Canada, awarded contract for a 2 story, 42 x 177 ft. addition to plant. Estimated cost $200,000.

Ont., Windsor — Chrysler Motor Corp., J. D. Mansfield, Pres. and Gen. Mgr., 300 Tecumseh Rd., plans addition to factory on Tecumseh Rd. Estimated cost $100,000.